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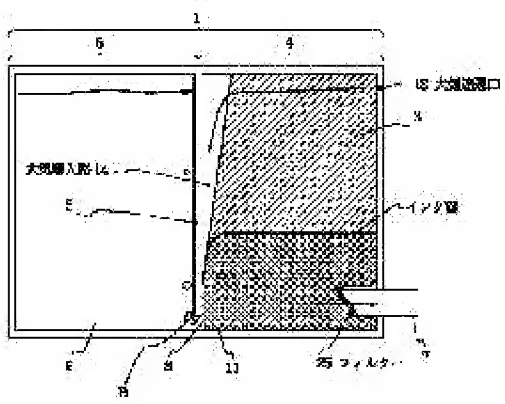
# (54) LIQUID CONTAINER



(57)Abstract:

PROBLEM TO BE SOLVED: To introduce the atmosphere forcibly into a communication passage at the time of supplying ink by providing an atmosphere introduction passage to a liquid containing chamber as a gap being formed when a negative pressure generating member is separated from the inner wall of a chamber containing the negative pressure generating member.

SOLUTION: A gas for providing an atmosphere introduction passage 14 is formed between a rib 5 at a negative pressure generating member containing section 4 and an absorber 3 while extending to the vicinity of a gap 8 between the end B of rib and the bottom 11 of an ink tank. It is communicated with the atmosphere through an atmosphere communication port 13. When an ink 9 begins to be fed from an ink supply section and the absorber 3 consumes some quantity of ink to bring about a predetermined negative pressure in the ink supply section, an ink face is formed stably in the absorber 3 thus forming a meniscus between the ink and the atmosphere in the vicinity of the gap 8. Consequently, gas-liquid exchange is performed quickly between the ink in the ink containing section and the atmosphere at the time of supplying ink.

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## CLAIMS

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[Claim(s)]
[Claim 1] While it is open for free passage through the negative pressure generating member receipt room which was equipped with atmospheric air, the atmospheric-air free passage section open for free passage, and the liquid feed zone for supplying a liquid to a fluid injection head, and contained the negative pressure generating member inside, said negative pressure generating member receipt room, and a free passage way It is the liquid stowage container for fluid injection heads which has the liquid receipt room which is sealing substantially except for said free passage way. In the consumption process of said liquid, the oil-level height in said negative pressure generating member The atmospheric-air installation way in which the atmospheric-air installation to said liquid receipt room for enabling vapor-liquid exchange in said free passage way in the condition of having maintained up is more possible than said free passage way as a clearance formed because said negative pressure generating member separates from said negative pressure generating member receipt indoor wall The liquid stowage container characterized by being constituted.
[Claim 2] Said liquid feed zone and said atmospheric-air free passage section are a liquid stowage container according to claim 1 characterized by making the seal by one member at the time of the PD.
[Claim 3] Said liquid stowage container is a liquid stowage container according to claim 1 characterized by consisting of ingredients which can check the interior by looking.
[Claim 4] The liquid stowage container according to claim 1 characterized by containing the liquid contributed to image formation in said liquid stowage container.
[Claim 5] Said negative pressure generating member is a liquid stowage container according to claim 1 which is the sponge which has not performed heat compression processing and is characterized by having compressed the sponge which has not performed this heat compression processing, and having contained to said negative pressure generating member receipt interior of a room.
[Claim 6] Said negative pressure generating member is a liquid stowage container according to claim 1 characterized by being the sponge which performed heat compression processing.
[Claim 7] The liquid stowage container according to claim 1 characterized by being placed between the paths which connect said atmospheric-air free passage section and the upper limit of said atmospheric-air installation way by said negative pressure generating member.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid stowage container of the configuration which can offer the stable negative pressure especially to said fluid injection head about the liquid stowage container which stored the liquid supplied to a fluid injection head.
[0002]
[Description of the Prior Art] Conventionally, as a liquid stowage container (henceforth an ink tank) which supplies a liquid (henceforth ink), it roughly classifies into the fluid injection head for ink jet recording devices (henceforth a recording head), and the following two are mentioned.
[0003] One has the method with which an ink tank is built in in the body of an ink jet recording device, and an ink supply pipe etc. is about in a body from an ink tank, it makes it combine with a recording head, and supplies ink.
[0004] This method becomes what has the big supply system of ink, and the miniaturization of the body of equipment and low-cost-izing are difficult. Moreover, since the ink in a supply system tends to be disrupted, the regurgitation recovery system (device) for raising regurgitation dependability will become large-scale and it becomes abundant [ the ink consumption which about / being difficult / and recovery takes too to achievement of the miniaturization of equipment, and low-cost-izing ], it leads to the problem of processing of waste ink, as a result increase of a running cost.
[0005] However, the approach for maintaining the stable meniscus in the ink discharge part of a recording head can be attained by attaching an ink tank caudad to the location of a recording head, and easy and the stable negative pressure are generated for it by the ink delivery section of a recording head.
[0006] The 2nd has the ink tank which maintains the meniscus which contained the absorber as a negative pressure generating member in [ whole ] the ink tank, and held ink with the absorber, and was stabilized in the ink delivery section of a recording head. This general absorption object ink tank method by making ink with a little less absorber than the amount of ink in which the maximum maintenance is possible hold, and generating a meniscus inside the absorber by the side of the atmospheric-air free passage section Since internal negative pressure predetermined by the ink feed zone is generated, by adjusting the capillary tube force of an ink tank in consideration of the ink water head difference of the meniscus inside the absorber by the side of the atmospheric-air free passage section, and the discharge part of a recording head It is possible to maintain the stable meniscus in the discharge part of a recording head, and the regurgitation of stable ink is possible. However, conventionally, the well-known general absorption object ink tank method had few amounts of ink to the ink tank volume (rate of ink relative retention) which can be held, and having considered that an ink tank countered and carried out a writing scan to the recording paper with a recording head, it had become the technical problem improved on the miniaturization of the body of a recording device, and reduction-izing of a running cost. Especially, in the ink jet recording device of printing posture good transformation, a miniaturization is an important element, the stable internal negative pressure can be generated and the method with the high rate of ink relative retention is needed.
[0007] On the other hand, the spring bag ink tank method using the ink bag energized in

the ink tank by means of a spring is indicated by JP,56-67269,A or JP,59-98857,A. Although the spring bag method is excellent in the point of it being stabilized and generating the internal negative pressure in an ink feed zone using the spring force, there are also many troubles, like constraint of the spring configuration for obtaining predetermined internal negative pressure and the process which fixes a bag to an ink tank become a little complicated, and the rate of ink relative retention becomes small by that a manufacturing cost is high and the further thin ink tank.

[0008] Moreover, the break and the partition ink room ink tank method made to open for free passage mutually by the pore in which negative pressure generating is possible are indicated by JP,02-214666,A in the inside of an ink tank at two or more ink rooms. The partition ink room method of this indication is a method which is generating the internal negative pressure in an ink feed zone according to the capillary tube force of pore in which the ink room is made to open for free passage mutually. Since a partition ink room method can simplify the configuration of an ink tank compared with a spring bag method, it is advantageous to an advantageous thing and the configuration of an ink tank in respect of a manufacturing cost at a point with little structural constraint. However, when the maintenance posture of an ink tank is changed by the partition ink room method of the above-mentioned affair indication, it may be in the condition that there is no ink of the pore section depending on an ink residue, the internal negative pressure by pore may become unstable, ink leakage may occur, and the constraint on ink tank handling is large.

[0009]

[Problem(s) to be Solved by the Invention] This invention is made in order to improve the technical technical problem in various kinds of ink tank gestalten as mentioned above, and a partition ink room ink tank method is improved. And the rate of ink relative retention which was excellent in handling nature is high, and there is no ink leakage to an environmental variation, a negative pressure property is stabilized and it aims at realizing the gestalt of the ink tank which performs ink supply stabilized in the recording head, without affecting the regurgitation property of ink.

[0010]

[Means for Solving the Problem] The atmospheric-air free passage section which was proposed in order that this invention might attain the above-mentioned purpose, and is open for free passage with atmospheric air, While it is open for free passage through the negative pressure generating member receipt room which equipped the fluid injection head with the liquid feed zone for supplying a liquid, and contained the negative pressure generating member inside, said negative pressure generating member receipt room, and a free passage way It is the liquid stowage container for fluid injection heads which has the liquid receipt room which is sealing substantially except for said free passage way. In the consumption process of said liquid, the oil-level height in said negative pressure generating member It is characterized by constituting the atmospheric-air installation way in which the atmospheric-air installation to said liquid receipt room for enabling vapor-liquid exchange in said free passage way is possible from a condition of having maintained more nearly up than said free passage way, as a clearance formed because said negative pressure generating member separates from said negative pressure generating member receipt indoor wall.

[0011] Moreover, the seal according [ said liquid feed zone and said atmospheric-air free passage section ] to one member in the time of the PD is made.

[0012] Moreover, said liquid stowage container consists of ingredients which can check the interior by looking.

[0013] Moreover, the liquid contributed to image formation is contained in said liquid stowage container.
[0014] Moreover, said negative pressure generating member is sponge which has not performed heat compression processing, compressed the sponge which has not performed this heat compression processing, and has contained it to said negative pressure generating member receipt interior of a room.
[0015] Moreover, said negative pressure generating member is characterized by being the sponge which performed heat compression processing.
[0016] Moreover, it is placed between the paths which connect said atmospheric-air free passage section and the upper limit of said atmospheric-air installation way by said negative pressure generating member.
[0017] Thereby, it makes it fracture the meniscus in said free passage way whether you are stability and Sumiya, and the vapor-liquid exchange with the ink of the ink hold section is made to perform good by introducing atmospheric air into said free passage way compulsorily using an atmospheric-air installation path at the time of ink supply.
[0018]
[Embodiment of the Invention] Drawing 1 is the sectional view showing the condition of association of the recording head of the ink jet recording apparatus of this invention, an ink tank, and carriage. The recording head 20 in this example is the thing of the Bubble Jet which records using the electric heat exchange object which generates the heat energy for producing and cheating out of film boiling to ink according to an electrical signal. In drawing 1 , by making into positioning criteria the projection 111-1,111-2 for positioning prepared in the head base plate 111, all the main configurations of a recording head 20 are pasted up or stuck by pressure on the head base plate 111, and laminating arrangement of them is done, and they change. Here, the vertical direction within a field of drawing 1 is positioned by the head positioning section 104 of Carriage HC, and projection 111-2. Furthermore, the perpendicular direction of the crossing Fig. of drawing 1 is positioned in a projection, and the notching section (un-illustrating) and the head positioning section 104 of this projection 111-2 so that a part of projection 111-2 may cover the head positioning section 104. To the head flexible substrate (henceforth "Head PCB") 105 which has wiring which arranged on the edge the pad which it comes to form the electric thermal-conversion object (regurgitation heater) arranged on seriate [ two or more ], and electric wiring, such as aluminum which supplies power to this, by the membrane-formation technique on Si substrate, and receives the electrical signal from the main frame, the heater board 113 makes each wiring correspond, and is connected by wirebonding. While pressing the slot top plate 112 which really cast the common liquid room which introduces ink from the exchange ink tank 1 through the septum and passage for classifying two or more ink passage respectively corresponding to a regurgitation heater, and is supplied to ink passage, and the orifice which forms two or more deliveries by Pori Sall John etc. with a non-illustrated spring on the heater board 113, using encapsulant, it sticking-by-pressure-fixes, and closes, and the ink discharge part is formed.
[0019] In order to enable the exchange ink tank 1 and association, while making it penetrate to the opposite side of the head base plate 111 through the hole established in the head PCB 113 and the head base plate 111 in this example, adhesion immobilization of the passage 115 by which the joint closure was carried out to the slot top plate 112 is carried out in the penetration section at the head base plate 111. Moreover, the filter 25 for preventing the inflow of the dust to a discharge part, air bubbles in narrow

circumstances, etc. is formed in the edge of the side combined with the ink tank 1 of passage 115.
[0020] The ink tank for exchange is combined with a recording head 20 by the engagement guide and the pressurization means 103, and when the ink absorber of an ink feed zone touches the filter 25 prepared at the tip of passage 115, association is made mechanically. Ink association is performed to a recording head 20 after association using the recording head suction recovery pump 5015 of the body of a recording device etc. by carrying out supply restoration of the ink compulsorily from the exchange ink tank 1.
[0021] In this example, since a recording head 20 and Carriage HC being mechanical and electrical installation will be made in the same direction while a recording head 20 and the ink tank 1 for exchange are combined at the time of engagement by the pressurization means, positioning with the pad on a head PCB 105 and the head drive electrode 102 is also ensured.
[0022] A little thick elastic body ring constitutes the ring seal from this example so that the backlash of an ink feed zone can be permitted and a joint with an exchange ink tank outer wall can be taken width.
[0023] As explained above, while ensuring positioning with the easy configuration with carriage and a recording head, since it was made to equip carriage after combining a recording head and an exchange ink tank simply out of a body, exchange actuation was able to be made easy at this example by energizing an exchange ink tank, after fully combining the exchange ink tank 1 and a recording head 20. Moreover, since it constituted from this example so that electrical installation of carriage (body of a recording device) and a recording head might also be performed to coincidence, the operability at the time of exchange of a recording head and an exchange ink tank is good, and it is also good to make high the configuration degree of freedom for making electrical installation into a connector connection type etc. separately, and making association with positioning of a recording head, and an exchange ink tank into a more positive thing.
[0024] Here, in order to explain the arrangement and actuation of a recording head in the ink jet recording device in this example, drawing 4 of a printing posture is used every width, and actuation of a recording device is explained. By drawing 4 , a record medium P is guided upwards from a space lower part using the plan ten roller 5000, and it presses to the plan ten 5000 covering the carriage migration direction with the paper presser-foot plate 5002. Carriage HC inserts a carriage migration pin in the spiral sulcus 5004, and reciprocates right and left along with the recording surface of the record medium P which support engagement was carried out and was guided on the plan ten roller 5000 at the slider 5003 arranged in parallel with the leading screw 5005 and leading screw which operate as a driving source because itself rotates. Through the drive transfer gears 5011 and 5009, a leading screw 5005 is interlocked with the forward inverse rotation of a drive motor, and rotation drive control is carried out. 5007 and 5008 are the home-position detection means for checking existence [ in this region of the lever 5006 of carriage ] with a photo coupler, and performing a hand-of-cut change-over of a motor 5013 etc.
[0025] An image recording signal measures timing to migration of the carriage which carries a recording head, is sent to a recording head, and records by making an ink droplet breathe out by the position. 5016 is the member which supports the cap member 5022 which caps the front face of a recording head, and 5015 is a suction means to attract the inside of this cap, and performs suction recovery of a recording head through the opening 5023 in a cap. 5017 is a cleaning blade, 5019 is a member which makes this blade

movable to a cross direction, and these are supported by the body support plate 5018. A suction means, a blade, etc. do not need to be this gestalt and it cannot be overemphasized that a well-known thing can be applied. Moreover, it is a lever for deciding the timing of suction recovery action, and it moves with migration of the cam 5020 which engages with carriage, and, as for 5012, migration control of the driving force from a drive motor is carried out with a means of communication with a well-known clutch change-over etc. When carriage comes to a home-position side field, these recovery means are constituted so that desired processing can carry out to predetermined timing according to an operation of a leading screw 5005 in those correspondence locations.

[0026] Now, then, the example of the ink tank of this invention is explained to a detail.

[0027] First, the configuration and the principle of operation of the ink tank which serves as a foundation of this invention first are explained.

[0028] (Configuration) As shown in drawing 2 , the body of an ink tank has the opening 2 for connecting with an ink jet recording head, adjoins the negative pressure generating member hold section 4 and this negative pressure generating member hold section which held the negative pressure generating member 3 through a rib 5, and consists of the ink hold section 6 which holds the ink 9 which was open for free passage through the clearance section 8 of the ink tank pars basilaris ossis occipitalis 11.

[0029] (Principle of operation (1)) Drawing 2 is a type section Fig. when the joint member 7 which supplies ink 9 to the ink jet recording head 20 being inserted in the ink tank 1 of this invention, carrying out a pressure welding to the negative pressure generating member 3, and changing into the condition that an ink jet recording device can work. In addition, in order to eliminate the dust in an ink tank, the filter 25 may be installed in the edge of the joint member 7.

[0030] If an ink jet recording apparatus works, ink will be breathed out from the orifice of the ink jet recording head 20, and an ink suction force will occur on the ink tank 1. Ink 9 passes along the clearance section 8 which is between the ink hold section 6 to the rib edge B, and the ink cartridge pars basilaris ossis occipitalis 11, and opens the ink stowage 6 and the negative pressure generating member hold section 4 for free passage with this suction force, is drawn in the joint member 7 through the negative pressure generating member 3, and is supplied to the ink jet recording head 20 to the negative pressure generating member hold section 4. Thereby, except clearance section 8, the pressure inside the sealed ink hold section 6 declines, and differential pressure is produced between the ink hold section 6 and the negative pressure generating member hold section 4. If record continues, the differential pressure will continue a rise, but since the negative pressure generating member hold section 4 is wide opened by atmospheric air with the atmospheric-air free passage hole 13, air goes into the ink hold section 6 through the negative pressure generating member 3 from the clearance section 8 of the rib edge B and the ink cartridge pars basilaris ossis occipitalis 11. At this time, the differential pressure of Hazama of the ink hold section 6 and the negative pressure generating member hold section 4 is canceled. During ink jet record, this actuation is repeated and a certain fixed negative pressure is obtained in an ink cartridge. Moreover, except ink 9 adhering to the wall surface in the ink hold section 6, since the ink 9 in the ink hold section 6 can be used mostly altogether, its ink utilization ratio improves.

[0031] (Principle of operation (2)) Based on the principle of operation (1) of this ink tank mentioned above, the easy model for explaining the principle of operation of this ink tank is shown in drawing 10 , and the more detailed principle of operation (2) is described.

[0032] In drawing 10 , the ink hold section 106 was equivalent to the ink hold section 6, and ink is contained. 102 and 103-1,103-2 are the capillary tubes which expressed the negative pressure generating member 3 typically from the functional side, and generate negative pressure in an ink tank according to the force of the meniscus. 107 is equivalent to the joint member 7, and is combined with the ink jet recording head which is not illustrated, this field is a part equivalent to the ink feed zone which supplies ink from an ink tank, and is that ink is breathed out from an orifice, and flow Q of ink produces it.
[0033] This drawing is equivalent to the condition of having consumed ink for a while from the ink and the ink hold section in a negative pressure generating member which can be supplied, from the condition that the ink hold section and a negative pressure generating member were enough filled up with ink, and is in the head in the orifice of a recording head, the reduced pressure condition within the ink hold section 106, and the condition with which the capillary tube force of 102 and 103-1,103-2 balanced. If ink supply is made from an ink feed zone, the height of the capillary tube of 103-1,103-2 will hardly change, but will be consumed through 108 by which ink is equivalent to the clearance section 8 from the ink hold section 106. Atmospheric air is incorporated in the ink hold section 106 as air bubbles by the meniscus of the capillary tube of 102 displacing, becoming a cellular configuration, and the meniscus being further torn according to increase of the negative pressure in the ink hold section 106 in that case. While ink distribution of inside [ without changing the height of the capillary tube of 103-1,103-2 by this (i.e., a negative pressure generating member) ] had maintained the balance of internal pressure mostly, without most changing, ink is consumed from the ink hold section 106 by ink supply.
[0034] Namely, if ink supply is made, although change of the volume integral arises as a variation rate of a meniscus with the capillary tube of 102 and a changed part of the surface energy of the meniscus in that case increases the negative pressure of an ink feed zone as a part for pressure loss, only an ink feed zone to the amount Q of ink A meniscus is fractured and it is incorporated by ink hold circles as air bubbles, and at last, by being exchanged in air bubbles and ink, a meniscus also returns and the internal pressure of an ink feed zone is also maintained by predetermined internal pressure according to the capillary tube force of 102.
[0035] Drawing 11 shows signs that the internal pressure in the ink feed zone of the ink tank of this example changes according to the ink amount of supply (consumption). In an initial state ( drawing 14 ), the ink supply from the negative pressure generating member hold section starts as mentioned above. That is, since the ink which exists in the negative pressure generating member hold section is supplied until a meniscus is formed in the ink interior wall lower limit section 8, i.e., the clearance section, the internal pressure of an ink feed zone has occurred like the ink tank of the conventional general absorption object method by balance of the capillary tube force on the top face of ink of the compression ink absorber of negative pressure generating member hold circles (gas-liquid interface), and the own head of ink. If it will be in the condition ( drawing 15 ) that the ink of the negative pressure generating member hold section decreases in number with ink supply (consumption), and a gas-liquid interface is formed in the ink room lower limit section like ****, the ink supply from the ink hold section will start, and while the internal pressure of an ink feed zone comes to be maintained and ink is supplied by the capillary tube force of the compression ink absorber near the ink room lower limit section from the ink hold section, almost fixed internal pressure is held. If ink is consumed further, the ink of the ink hold section is consumed mostly and the liquid ink side of the ink hold section

becomes low from the ink interior wall lower limit section ( drawing 16 ) Atmospheric air is supplied to the ink hold section at a stretch, and the ink hold section is completely open for free passage with atmospheric air. Since some ink which was carrying out the remainder to the ink hold section is absorbed by the compression ink absorber of the negative pressure generating member hold section and the ink of negative pressure generating member hold circles increases, only in the part to which an ink top face (gas-liquid interface) goes up a little, the internal pressure of an ink feed zone changes in the forward direction a little. Furthermore, although the ink of the negative pressure generating member hold section will begin to be again consumed if ink is consumed, since atmospheric air begins to be supplied to ** and a recording head by the ink feed zone, the bottom of a gas-liquid interface serves as a limitation of ink supply from it ( drawing 17 ), and exchange of an ink tank is needed.

[0036] By making some ink flow out of an ink tank, while removing the air bubbles in the ink passage which performs suction recovery with the suction means of the above-mentioned body of a recording device at the time of association to a recording head, and is generated in examination of this invention person at the time of association It is possible from the first stage to maintain the stable ink internal pressure, when consuming the ink of the negative pressure generating member hold section just before the first stage and exchange, it is satisfactory to a recording characteristic in any way at the ink adequate supply period shown in drawing 11 , and good record was able to be performed.

[0037] The mechanism described above showed that there was the important following point in order to supply ink.

[0038] It is the thing of the clearance section 8 for which it is stabilized very much in near and the meniscus of ink and atmospheric air needs to be formed. Otherwise, ink must be supplied until it makes internal pressure of an ink feed zone into quite large negative pressure, in order to carry out the variation rate of the meniscus and to move it to the ink hold section. If it becomes so, it will become disadvantageous, in order for the drive with high frequency to become difficult and to perform high-speed printing.

[0039] Drawing 11 does not show signs that the internal pressure in the ink feed zone of this ink tank explained previously changes according to the ink amount of supply (consumption), and shows the so-called static negative pressure in the condition of not performing ink supply, and the so-called dynamic negative pressure in the condition of performing ink supply.

[0040] the meniscus which is the pressure loss at the time of the difference of dynamic negative pressure and static negative pressure supplying ink in this drawing, and was explained previously -- a ratio with the big negative pressure produced in the case of a variation rate is closed.

[0041] Therefore, it is the point of this invention to make the meniscus in this part fracture you to be Sumiya, and the means for it is preparing the atmospheric-air installation way which introduces atmospheric air compulsorily near the clearance section 8, and shows that example below.

[0042] It is what showed the 1st example of this invention to <example 1> drawing 3 , and explains to a detail based on this drawing. Although the negative pressure generating members 3 of an ink tank are absorbers, such as urethane foam When this absorber 3 supplies the negative pressure generating member hold section 4, the clearance used as the atmospheric-air installation way 14 is formed between the rib 5 of the negative pressure generating member hold section 4, and an absorber 3. Even near the clearance section 8 of the rib edge B and the ink tank pars basilaris ossis occipitalis 11 It is the

configuration in which the atmospheric-air installation way 14 is extended as the clearance section. And it is open for free passage with atmospheric air through atmospheric-air free passage opening. For this reason, if it begins to supply ink 9 from the ink feed zone 2, a certain amount of ink will be consumed from an absorber 3, if the internal pressure of the ink feed zone 2 reaches predetermined negative pressure, an ink side as shown in drawing 3 will be stabilized and formed into an absorber 3, and a meniscus will be formed by Hazama of ink and atmospheric air near the clearance section 8. And if it resulted in this condition, since it was stabilized without making pressure loss **P into a not much big value as a result of being able to make the meniscus in the clearance section 8 fracture immediately and ink was supplied by supply of subsequent ink 9, moreover, high-speed printing was attained [ that regurgitation stability is good and ].

[0043] The own capillary tube force (or meniscus force in an ink-negative pressure generating member interface) of a negative pressure generating member etc. is discovered at the time of un-recording, and it controls that ink leaks from an ink jet recording head.

[0044] In addition, since the ink tank 1 of this invention is corresponded to a color ink jet recording apparatus, it can be used, respectively, being able to hold the ink of each color (for example, black, yellow, a Magenta, four colors of cyanogen) in the ink tank according to individual. Moreover, it is good also as an exchange mold ink cartridge which was made to unify the ink cartridge according to individual, and separated the exchange mold ink cartridge good also as an ink tank or for black ink with high operating frequency, and other color ink unification exchange cartridges. Such combination is arbitrary according to ink jet equipment.

[0045] This invention is explained more below at a detail.

[0046] In the ink tank of this invention, in order to control the negative pressure in an ink jet recording head Selection of the negative pressure generating member 3, a configuration, and a dimension from the first The configuration of the rib edge B, A dimension, the configuration of the clearance section 8 of Hazama of the rib edge B and the ink tank pars basilaris ossis occipitalis 11, It is desirable to optimize the roughness of a dimension, the volume rate of the negative pressure generating member hold section 4 and the ink hold section 6, the amount of insertion to the ink tank of the joint member 7, a configuration, a dimension, the configuration of a filter 25, a dimension, and an eye, the surface tension of ink, etc.

[0047] If the negative pressure generating member 3 used by this invention has in itself the capacity to hold ink also to a self-weight and a slight vibration of a liquid (ink), a well-known member can be conventionally used for it. for example, it is ****** reticulated about fiber -- the porous body which has a curdy object and a free passage hole is raised. ink holding power, negative pressure generating, etc. -- adjustment -- sponge, such as easy polyurethane foam, is desirable. Since it can adjust especially in the case of form so that it may become a desired porous consistency at the time of form manufacture, it is desirable. In addition, since the decomposition product by heating may be generated, ink physical properties may be changed and it may have a bad influence on record grace when heat compression processing is carried out for form and a porous consistency is adjusted further, processing of washing etc. is needed. Moreover, although the form of a porous consistency according to it is required in order to manufacture the ink cartridge corresponding to various ink jet recording apparatus, it is desirable to cut into the dimension of a request of form material with the specific number of cels (the number of the holes per inch) which has not performed heat compression, to carry out

compression insertion at the negative pressure generating member hold section 4, and to adjust a porous consistency and the capillary tube force.
[0048] In an ink cartridge (ink tank) with the ink hold section 6 of a sealing system (Environmental variation within an ink jet recording apparatus) As opposed to external-environment change (a temperature rise or atmospheric-pressure fall) in the condition of having been loaded into the ink jet recording device The ink 9 which remains in (there is also expansion of ink) and the ink hold section 6 by air expansion of the ink hold section is extruded out of the ink hold section 6, and, as a result, there is possibility of ink leakage generating out of an ink tank. However, in the ink cartridge of this invention, it is desirable to expect the air expansion volume (for a part for ink expansion to also be included although it is small) of the sealing system ink hold section 6 according to the environment condition by which the worst assumption is carried out, and to give a part for the ink movement magnitude from the ink hold section 6 accompanying it beforehand to the negative pressure generating member hold section 4. In addition, if the installation location of the atmospheric-air free passage hole 13 is the upper part [ opening / as an ink feed hopper 2 by the side of the negative pressure generating member hold section 4 / joint ], especially assignment will not be carried out, but in order to separate the flow of the ink in the negative pressure generating member 3 at the time of an environmental variation from joint opening, it is desirable that it is in a location distant from joint opening. Moreover, the number of the atmospheric-air free passage holes 13 and a configuration, magnitude, etc. can be set as arbitration in consideration of evaporation of ink.
[0049] (Ink cartridge independent PD) an ink cartridge -- the time of the independent PD -- setting -- joint opening -- and -- or it is desirable to seal the atmospheric-air free passage hole 13 by a sealant etc., and to prepare for evaporation of ink or the air expansion in an ink cartridge. It is desirable to use the compound-ized barrier material which compound-ized reinforcing materials, aluminium foil, etc., such as compound-izing and these and paper of the barrier of a simple substance layer and the plastic film of several layers which are called a barrier material in the package field as a sealant, and cloth. It is more desirable by making the ink cartridge body quality of the material and the same quality of the material into the glue line of a barrier material, and welding with heat etc. to raise sealing nature.
[0050] Moreover, in order to control evaporation of the ink from an ink cartridge, or the inflow of the air from external atmospheric air, after inserting an ink cartridge, it is effective if the package gestalt sealed after deaerating the air in an wrapping material is taken. It is desirable to choose from a barrier material like the above-mentioned sealant in consideration of gas transmittance and liquid transmittance as an wrapping material.
[0051] By choosing the above package gestalten, the ink cartridge independent PD does not have ink leakage etc., and becomes what has very high dependability.
[0052] (The manufacture approach) Although an ink cartridge body material may be what kind of ingredient conventionally used for mold goods, it is necessary to choose it from an ingredient which does not have the effect on the ink for ink jets, or the member processed so that it might be uninfluential. Moreover, it is also necessary to take the productivity of an ink cartridge into consideration. For example, an ink cartridge body is divided into ink cartridge pars-basilaris-ossis-occipitalis 11 part and its upper part, each is really fabricated with a resin ingredient, after inserting the negative pressure generating member 3, ink cartridge pars-basilaris-ossis-occipitalis 11 part and its upper part can be welded, and an ink cartridge body can be manufactured. Since the ink of the ink hold

section can be checked by looking from the ink cartridge outside if transparence or a translucent thing is chosen as a resin ingredient, the replacement stage of an ink cartridge can be judged visually. Moreover, in order to make joining, such as the above-mentioned sealant, easy, it is desirable to prepare heights as shown in drawing. Furthermore, it is also desirable on a design to process a crimp etc. on the external surface of an ink cartridge body.

[0053] restoration of ink -- pressurization and a manometric method -- any -- although -- it can be used. In addition, since other ink cartridge openings are not soiled, it is desirable to prepare ink restoration opening in restoration of ink at either of the tank bodies. As for ink restoration opening after ink restoration, it is desirable to carry out a plug with plastics or a metallic material.

[0054] The configuration and configuration of an ink cartridge can perform various kinds of deformation, without deviating from the range of this invention.

[0055] (in addition to this) This ink tank (cartridge) may be used as an exchange mold, and may be made to unite with a recording head.

[0056] Moreover, when used as an exchange mold, it is desirable to carry out recovery action, such as automatic detection of the exchange tank by the body or suction by the user itself.

[0057] Moreover, although it is needless to say, you may use as an ink jet printer which records on the recording head 20 from which four recording heads were united, and which they consisted of like drawing 18 by combining the exchange ink tank of Bk(black) 1a, C(cyanogen)1b, M(Magenta)1c, and four Y(yellow)1d colors.

[0058] <Example of a comparison> It is shown mixing signs that internal pressure [ in /, for the example of a comparison in this example / the ink feed zone of an ink tank ] changes here according to the ink amount of supply.

[0059] Especially in this ink tank, an atmospheric-air installation way is not prepared but the absorber of an almost uniform pore size distribution is built in at negative pressure generating member hold circles.

[0060] It is in the condition that ink hold circles were mostly filled up with ink like drawing 14 in the state of the first stage, and negative pressure generating member hold circles are also filled up with a certain amount of ink. If ink supply begins from this condition, since the ink from the negative pressure generating member hold section is supplied and the ink top face descends as ink supply progresses although the internal pressure of an ink feed zone has occurred by balance with the head of ink the capillary tube force on the top face of ink of the absorber of negative pressure generating member hold circles (gas-liquid interface), and own, negative pressure increases almost linearly to that height first. It will be in the condition of a of drawing 13 . If it will not be in the condition that a gas-liquid interface (meniscus) is formed in the clearance section which is the lower limit section of an ink room, with ink supply as it is, the negative pressure of an ink feed zone will increase rapidly.

[0061] And by the time the meniscus in the clearance section will be formed, the ink side within an absorber will descend considerably, and an oil level will descend depending on [ section / with a head / joint ] the case.

[0062] If it becomes like this, atmospheric air will be taken in in a recording head, the regurgitation will become unstable, and it will keep in the non-regurgitation very much.

[0063] Moreover, although it does not become such, the internal pressure of an ink feed zone may become still larger like the condition of b of drawing 13 exceeding the fixed negative pressure decided by pore size of the absorber of the clearance section. This is

considered that the absorber is in a condition like a model which showed [ although some are compressed with the wall of the negative pressure generating member hold section, ] the perimeter by drawing 12 exactly since a wall did not exist in the clearance section and it was not compressed, and compressibility was small a little compared with the perimeter.

[0064] This drawing is in the condition which consumed ink from the negative pressure generating member hold section to some extent. When ink is further supplied from this condition, the pore size of an absorber is R2, R3, and R4. R4 [ largest ] in inside The meniscus of a part is R3 and R4. If displacement migration is greatly carried out compared with a part and it comes even near the clearance section succeedingly Since the meniscus force becomes weaker suddenly, atmospheric air is crowded with a meniscus moving even to an ink hold section side, and the meniscus fracturing for the ink hold section. At this time, it is R2. A part to R3, and R4 Ink is consumed for a while also from a part. Pressure loss **P in the case of migration of the meniscus in this case will become comparatively big.

[0065] However, by the vigor in the case of a return, the meniscus fractured once will also be in the high condition of pressure loss as it is for the time being in order to form a meniscus in the place again near the original location.

[0066] And a meniscus is the pore size R1 of the clearance section. Once it repeats the same thing and a meniscus is stabilized in the clearance section until it is stabilized into a part, it is the pore size R1 of the clearance section. Air bubbles go into the ink hold section, and are stabilized until it becomes the decided negative pressure.

[0067] The condition so far is in the condition of drawing 13 -b, and it is in the condition of consuming ink from the both sides of the ink hold section and an absorber. Thus, since pressure loss **P at the time of ink supply also becomes large, a regurgitation property may get worse and high-speed printing may become difficult, without stabilizing the internal pressure in an ink feed zone as mentioned above, if an atmospheric-air installation way is not set up.

[0068] The example of reference was shown in <example 1 of reference> drawing 5 .

[0069] In this example of reference, two ribs 61 were formed inside [ negative pressure generating member hold section 4 ] the screen rib 5. The rib 61 is formed even [ near the clearance section 8 ] from the head-lining part of an ink tank. The part pinched with the absorber 3 with Hazama of a rib serves as the atmospheric-air installation way 14.

[0070] by make it locate above the lower limit B of the screen rib 5 , since the lower limit A of this rib 61 only insert the absorber 3 of a rectangular parallelepiped configuration into the negative pressure generating member hold section 4 and can cover the clearance section 8 with an absorber 3 , it become possible [ consider as the configuration which draw the atmospheric air installation way 14 stabilized simply to near the **** of the clearance section 8 ] . In addition, the absorber 3 intervenes between the contact of the head-lining part of a rib 61, and the atmospheric-air free passage hole 13.

[0071] Since an ink side and a meniscus as it is quick and shown in drawing 5 were formed and exchange of the air bubbles by crisp meniscus fracture and ink was moreover performed by ink supply according to printing when printed using this ink tank, it became possible to be able to perform now little ink supply of pressure loss, to be stabilized and to perform high-speed printing.

[0072] Other configurations of the atmospheric-air installation way 14 were shown in <example 2 of reference> drawing 6 , the rib 61 in the example 1 of reference and the same rib 71 were further increased to it, and the number of the atmospheric-air

installation ways 14 was increased to it, and the rib 71 was formed in it also at head lining of the negative pressure generating member hold section. In addition, the absorber 3 intervenes between the edge of a rib 71 established in the head-lining part, and the atmospheric-air free passage hole 13.
[0073] It became possible to be stabilized and to secure two or more atmospheric-air installation ways 14 from the atmospheric-air free passage opening 13 to near the clearance section 8, by this, and it became possible to be able to perform now little ink supply of pressure loss, to be stabilized and to perform high-speed printing like an example 1 and the example 1 of reference.
[0074] Moreover, even if it forms the atmospheric-air free passage hole 13 in the location distant from the clearance section 8, atmospheric installation becomes possible [ carrying out smoothly ].
[0075] Other examples of reference were shown in <example 3 of reference> drawing 7 .
[0076] In this example, like the examples 1 and 2 of reference, although it is forming a rib 81 in the screen rib 5 and the atmospheric-air installation way 14 is formed The path where the ink 9 which moves to the negative pressure generating member hold section 4 through the clearance section 8 by constituting a rib 81 asymmetrically to the screen rib 5 from the ink hold section 6 flows, It passes along the clearance section 8 from the flow of the ink 9, and the atmospheric-air installation way 14 generated complementary, and there is effectiveness which makes pressure loss for exchange small by making into the individual according to independence the path of the flow of the atmospheric air which enters into the ink hold section 6 to a center line A, respectively.
[0077] By carrying out like this, pressure loss **P for exchange of ink and air bubbles became abbreviation half.
[0078] This became possible from the recording head to perform the regurgitation of ink stabilized more.
[0079] Other modifications of a rib 91 are shown in <example 4 of reference> drawing 8 .
[0080] In the examples 1-3 of reference, although the upper limit of a rib 91 was lengthened even to the wall up side of the negative pressure generating member hold section, in this example, it does not lengthen to there but is considering as the short thing.
[0081] By carrying out like this, with a rib 91, it prevents compressing the upper part of an absorber, and the danger that the meniscus force will occur can be prevented in the compressed part, and control of negative pressure can be made into what was stabilized more.
[0082] Furthermore, the ink in an absorber is consumed until it shifts to the stable liquid ink side in detail from the liquid ink side in the absorber which is the negative pressure generating member 3 in the early ink tank by which ink is consumed. Namely, since consumption of the ink from an absorber 3 will decrease as a result of consuming ink from the ink hold section 6 if the too early vapor-liquid exchange through the atmospheric-air installation way 14 is urged, Since the amount of ink which can be moved to the negative pressure generating member hold section 4 by the ink from the ink hold section 6 is restricted at the time of environmental variations, such as atmospheric-pressure fluctuation, the evil in which the buffer effectiveness over the ink leakage of an absorber 3 is halved occurs. So, in this example, after ink was consumed to some extent in the absorber 3, the atmospheric-air installation way 14 was installed, the liquid ink side in an absorber 3 was controlled, and the buffer effectiveness over ink leakage was heightened so that atmospheric-air installation might be carried out.

[0083] In addition, while the liquid ink side level in an absorber 3 becomes possible [ maintaining stably ] to the atmospheric-air installation way 14 neighborhood and the ink 9 in the ink hold section 6 is consumed, almost fixed negative pressure (water head difference) is made generated. Thereby, the negative pressure to a head can be stabilized and stability of the regurgitation of the ink from a delivery is carried out.
[0084] Other examples of reference are shown in <example 5 of reference> drawing 9 .
[0085] At this example, the atmospheric-air installation way 14 is formed by establishing a slot 100 in a screen rib.
[0086] Since the strain of the compressibility of the absorber 3 held in the negative pressure generating member hold section 4 decreases and it is easy to carry out control of negative pressure, it is stabilized and ink can be supplied.
[0087] Other examples of reference are explained to <example 6 of reference> drawing 19 .
[0088] As a configuration, although it is almost the same as the example 5 of reference, a different place is that the atmospheric-air installation way 14 has composition from which it attached and escaped to the rib lower limit B.
[0089] The ink in an absorber is consumed until it shifts to the liquid ink side by which the height of the upper limit section C of the atmospheric-air installation way 14 was stabilized like the examples 4 and 5 of reference from the liquid ink side in the absorber 3 in the early ink tank by which ink is consumed. Although the ink 9 of the ink hold section 6 is consumed performing vapor-liquid exchange through the atmospheric-air installation way 14 after that, since the atmospheric-air installation way has stuck and fallen out to the rib lower limit B, it becomes the behavior which can be considered as a model like drawing 20 .
[0090] A model is used for below and it explains to a detail.
[0091] If the absorber 3 which is a negative pressure generating member is typically expressed from a functional side, it will be considered a capillary tube like drawing 20 , and it is thought that the atmospheric-air installation way 14 is connected from the part of the upper limit section C to the rib lower limit B, and the atmospheric-air installation way 14 is again connected with the capillary tube with the part of the upper limit section C to the up side.
[0092] As stated also in advance, the liquid ink side in an absorber 3 has a certain amount of height in the early ink tank by which ink is consumed, but gradually, the oil level falls and the internal pressure (negative pressure) in the ink feed zone 6 becomes large according to it as ink is consumed.
[0093] And if ink is consumed to the height of the part of the upper limit section C which is the upper limit of the atmospheric-air installation way 14, the liquid ink side will form the meniscus in the location of D in a capillary tube. Furthermore, if ink is received and consumed, a liquid ink side, i.e., a meniscus, will descend again, but if it comes to the location of E, since the meniscus force of the liquid ink side in the atmospheric-air installation way 14 becomes weaker rapidly, in order to consume the ink in the atmospheric-air installation way 14 at a stretch, after that, it will be this location and the ink of the ink hold section will come to be consumed. That is, vapor-liquid exchange comes to be performed. Therefore, during ink consumption, since [ of the height of the upper limit section C ] it is stabilized only in the downward location C, as for the internal pressure in the ink feed zone 6, a liquid ink side goes into a stable zone. And if ink supply stops, the meniscus in a capillary tube will carry out return stability again from the location of E in the location of D.

[0094] Thus, the liquid ink side in an absorber 3 goes back and forth between D and E until it consumes all the ink of the ink hold section 6.
[0095] And after that, in order to consume the ink in an absorber 3, again, the internal pressure (negative pressure) of the ink feed zone 2 increases, and serves as an ink piece.
[0096] By the way, since the internal pressure in the ink feed zone 6 is obtained from the capillary tube force (that is, an absorber is equivalent to the height which can suck up ink) of an absorber 3 as a difference for height of the liquid ink side in an absorber 3, if it is considered from it being necessary to the ink feed zone 2 to set up the height of the upper limit section C highly, it needs to make pore size of an absorber 3 to some extent small.
[0097] When it is clear and a liquid ink side becomes low from the ink feed zone 2, in order that the reason for setting up the height of the upper limit section C highly to the ink feed zone 2 may take in atmospheric air and may cause the poor regurgitation, it is for preventing it.
[0098] Moreover, it is not good to make it reverse not much high. That is, it is internal pressure change in an ink tank by the environmental variation, and is for the room of the buffer at the time of ink overflowing from the ink hold section 6 to an absorber 3 side to decrease. Then, the volume of the absorber 3 upper section is set as one half extent of the volume of the ink hold section 6 from the height of C.
[0099] The mechanism which gave [ above-mentioned ] explanation is described still more simply. <BR> [0100] That is, supposing an absorber 3 is a uniform consistency, the internal pressure (negative pressure) in the ink feed zone 2 will be decided by the difference of the height H2 by which ink is already sucked up from the height of the ink feed zone 2, H1-H2 [ i.e., ], from the height H1 which can be sucked up from the capillary tube force of an absorber 3, i.e., the height of the ink feed zone 2.
[0101] That is, the force of pulling up the ink of an absorber 3, for example is H1=60mm, and if the height of the part of C of the atmospheric-air installation way 14 is H2=15mm from the ink feed zone 2, the internal pressure of an ink feed zone will serve as H1-H2=60mm-15mm, and will serve as 45mmAq(s).
[0102] Therefore, internal pressure (negative pressure) falls in the linear mostly as ink 9 is consumed from an absorber 3 the first stage and the height of the oil level falls.
[0103] If the ink tank of a configuration of having explained above is used, ink supply by the stable negative pressure can be performed.
[0104] Moreover, since the configuration of the ink tank itself was also easily created with a mold etc., it became possible [ creating at a low price in large quantities ].
[0105] Ink is consumed further. The oil level in an absorber 3 next, to the place of the atmospheric-air installation way 14 Namely, since the ink in the atmospheric-air installation way 14 stops being able to carry out meniscus maintenance when it comes to the place of the upper limit section C (i.e., if a liquid ink side will be in the condition of E of drawing 20 ), It is absorbed at an absorber 3 side, an atmospheric path is formed, vapor-liquid exchange by atmospheric-air installation is performed at a stretch, on the other hand, an oil level will be in the condition of D because the oil level of an absorber 3 goes up again in the ink absorbed at the absorber 3 side, and vapor-liquid exchange stops. In this condition, all over the atmospheric-air installation way 14, there is no ink and the absorber 3 on the atmospheric-air installation way 14 which wrote as a model Fig. has already functioned as a valve simply. Here, it has the composition that the negative pressure generating member intervened between the upper limit section C of the atmospheric-air installation way 14, and the atmospheric-air free passage hole 13.

[0106] Therefore, if ink is again consumed in this condition, in order that the oil level of an absorber 3 may fall for a while, therefore a valve may open, Since vapor-liquid exchange will stop if it comes to the location of D although the oil level of an absorber 3 goes up according to the capillary tube force of an absorber if vapor-liquid exchange is performed at a stretch, the ink by the side of the ink hold section 6 comes to be consumed and ink consumption is completed, an oil level will be stabilized in the location.
[0107] Thus, a liquid ink side is stabilized and can be controlled by the height of the atmospheric-air installation way 14, i.e., the height of the upper limit section C, and if it adjusts beforehand, the capillary tube force of an absorber 3, i.e., the raising height of ink, will become possible [ controlling the internal pressure of the ink feed zone 2 simply ].
[0108] Moreover, in order to hold the ink with which it overflows to an absorber side from the ink hold section by change of ** in the ink tank by environmental change, ink 9 overflows with enlarging, the capillary tube force, i.e., the ink raising height, of an absorber, from an ink tank, or it prevents the ink feed zone 2 becoming positive pressure by it.
[0109]
[Effect of the Invention] It became possible to carry out vapor-liquid exchange of the ink and atmospheric air in the ink hold section at this invention whether you are stability and Sumiya at the time of ink supply, as explained above, consequently it became possible to be stabilized and to control the internal pressure in an ink feed zone, and, moreover, high-speed printing was attained [ that the regurgitation stability in a recording head is good, and ].
[0110] Moreover, it became possible to offer the ink tank to change of an external environment which ink leakage does not generate to the pressure variation in an ink tank.

## TECHNICAL FIELD

[Field of the Invention] This invention relates to the liquid stowage container of the configuration which can offer the stable negative pressure especially to said fluid injection head about the liquid stowage container which stored the liquid supplied to a fluid injection head.

## PRIOR ART

[Description of the Prior Art] Conventionally, as a liquid stowage container (henceforth an ink tank) which supplies a liquid (henceforth ink), it roughly classifies into the fluid injection head for ink jet recording devices (henceforth a recording head), and the following two are mentioned.
[0003] One has the method with which an ink tank is built in in the body of an ink jet recording device, and an ink supply pipe etc. is about in a body from an ink tank, it makes it combine with a recording head, and supplies ink.
[0004] This method becomes what has the big supply system of ink, and the miniaturization of the body of equipment and low-cost-izing are difficult. Moreover, since the ink in a supply system tends to be disrupted, the regurgitation recovery system

(device) for raising regurgitation dependability will become large-scale and it becomes abundant [ the ink consumption which about / being difficult / and recovery takes too to achievement of the miniaturization of equipment, and low-cost-izing ], it leads to the problem of processing of waste ink, as a result increase of a running cost.
[0005] However, the approach for maintaining the stable meniscus in the ink discharge part of a recording head can be attained by attaching an ink tank caudad to the location of a recording head, and easy and the stable negative pressure are generated for it by the ink delivery section of a recording head.
[0006] The 2nd has the ink tank which maintains the meniscus which contained the absorber as a negative pressure generating member in [ whole ] the ink tank, and held ink with the absorber, and was stabilized in the ink delivery section of a recording head. This general absorption object ink tank method by making ink with a little less absorber than the amount of ink in which the maximum maintenance is possible hold, and generating a meniscus inside the absorber by the side of the atmospheric-air free passage section Since internal negative pressure predetermined by the ink feed zone is generated, by adjusting the capillary tube force of an ink tank in consideration of the ink water head difference of the meniscus inside the absorber by the side of the atmospheric-air free passage section, and the discharge part of a recording head It is possible to maintain the stable meniscus in the discharge part of a recording head, and the regurgitation of stable ink is possible. However, conventionally, the well-known general absorption object ink tank method had few amounts of ink to the ink tank volume (rate of ink relative retention) which can be held, and having considered that an ink tank countered and carried out a writing scan to the recording paper with a recording head, it had become the technical problem improved on the miniaturization of the body of a recording device, and reduction-izing of a running cost. Especially, in the ink jet recording device of printing posture good transformation, a miniaturization is an important element, the stable internal negative pressure can be generated and the method with the high rate of ink relative retention is needed.
[0007] On the other hand, the spring bag ink tank method using the ink bag energized in the ink tank by means of a spring is indicated by JP,56-67269,A or JP,59-98857,A. Although the spring bag method is excellent in the point of it being stabilized and generating the internal negative pressure in an ink feed zone using the spring force, there are also many troubles, like constraint of the spring configuration for obtaining predetermined internal negative pressure and the process which fixes a bag to an ink tank become a little complicated, and the rate of ink relative retention becomes small by that a manufacturing cost is high and the further thin ink tank.
[0008] Moreover, the break and the partition ink room ink tank method made to open for free passage mutually by the pore in which negative pressure generating is possible are indicated by JP,02-214666,A in the inside of an ink tank at two or more ink rooms. The partition ink room method of this indication is a method which is generating the internal negative pressure in an ink feed zone according to the capillary tube force of pore in which the ink room is made to open for free passage mutually. Since a partition ink room method can simplify the configuration of an ink tank compared with a spring bag method, it is advantageous to an advantageous thing and the configuration of an ink tank in respect of a manufacturing cost at a point with little structural constraint. However, when the maintenance posture of an ink tank is changed by the partition ink room method of the above-mentioned affair indication, it may be in the condition that there is no ink of the pore section depending on an ink residue, the internal negative pressure by pore may become unstable, ink leakage may occur, and the constraint on ink tank handling is large.

## EFFECT OF THE INVENTION

[Effect of the Invention] It became possible to carry out vapor-liquid exchange of the ink and atmospheric air in the ink hold section at this invention whether you are stability and Sumiya at the time of ink supply, as explained above, consequently it became possible to be stabilized and to control the internal pressure in an ink feed zone, and, moreover, high-speed printing was attained [ that the regurgitation stability in a recording head is good, and ].

[0110] Moreover, it became possible to offer the ink tank to change of an external environment which ink leakage does not generate to the pressure variation in an ink tank.

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is made in order to improve the technical technical problem in various kinds of ink tank gestalten as mentioned above, and a partition ink room ink tank method is improved. And the rate of ink relative retention which was excellent in handling nature is high, and there is no ink leakage to an environmental variation, a negative pressure property is stabilized and it aims at realizing the gestalt of the ink tank which performs ink supply stabilized in the recording head, without affecting the regurgitation property of ink.

## MEANS

[Means for Solving the Problem] The atmospheric-air free passage section which was proposed in order that this invention might attain the above-mentioned purpose, and is open for free passage with atmospheric air, While it is open for free passage through the negative pressure generating member receipt room which equipped the fluid injection head with the liquid feed zone for supplying a liquid, and contained the negative pressure generating member inside, said negative pressure generating member receipt room, and a free passage way It is the liquid stowage container for fluid injection heads which has the liquid receipt room which is sealing substantially except for said free passage way. In the consumption process of said liquid, the oil-level height in said negative pressure generating member It is characterized by constituting the atmospheric-air installation way in which the atmospheric-air installation to said liquid receipt room for enabling vapor-liquid exchange in said free passage way is possible from a condition of having maintained more nearly up than said free passage way, as a clearance formed because said negative pressure generating member separates from said negative pressure generating member receipt indoor wall.

[0011] Moreover, the seal according [ said liquid feed zone and said atmospheric-air free passage section ] to one member in the time of the PD is made.

[0012] Moreover, said liquid stowage container consists of ingredients which can check the interior by looking.

[0013] Moreover, the liquid contributed to image formation is contained in said liquid

stowage container.
[0014] Moreover, said negative pressure generating member is sponge which has not performed heat compression processing, compressed the sponge which has not performed this heat compression processing, and has contained it to said negative pressure generating member receipt interior of a room.
[0015] Moreover, said negative pressure generating member is characterized by being the sponge which performed heat compression processing.
[0016] Moreover, it is placed between the paths which connect said atmospheric-air free passage section and the upper limit of said atmospheric-air installation way by said negative pressure generating member.
[0017] Thereby, it makes it fracture the meniscus in said free passage way whether you are stability and Sumiya, and the vapor-liquid exchange with the ink of the ink hold section is made to perform good by introducing atmospheric air into said free passage way compulsorily using an atmospheric-air installation path at the time of ink supply.
[0018]
[Embodiment of the Invention] Drawing 1 is the sectional view showing the condition of association of the recording head of the ink jet recording apparatus of this invention, an ink tank, and carriage. The recording head 20 in this example is the thing of the Bubble Jet which records using the electric heat exchange object which generates the heat energy for producing and cheating out of film boiling to ink according to an electrical signal. In drawing 1 , by making into positioning criteria the projection 111-1,111-2 for positioning prepared in the head base plate 111, all the main configurations of a recording head 20 are pasted up or stuck by pressure on the head base plate 111, and laminating arrangement of them is done, and they change. Here, the vertical direction within a field of drawing 1 is positioned by the head positioning section 104 of Carriage HC, and projection 111-2. Furthermore, the perpendicular direction of the crossing Fig. of drawing 1 is positioned in a projection, and the notching section (un-illustrating) and the head positioning section 104 of this projection 111-2 so that a part of projection 111-2 may cover the head positioning section 104. To the head flexible substrate (henceforth "Head PCB") 105 which has wiring which arranged on the edge the pad which it comes to form the electric thermal-conversion object (regurgitation heater) arranged on seriate [ two or more ], and electric wiring, such as aluminum which supplies power to this, by the membrane-formation technique on Si substrate, and receives the electrical signal from the main frame, the heater board 113 makes each wiring correspond, and is connected by wirebonding. While pressing the slot top plate 112 which really cast the common liquid room which introduces ink from the exchange ink tank 1 through the septum and passage for classifying two or more ink passage respectively corresponding to a regurgitation heater, and is supplied to ink passage, and the orifice which forms two or more deliveries by Pori Sall John etc. with a non-illustrated spring on the heater board 113, using encapsulant, it sticking-by-pressure-fixes, and closes, and the ink discharge part is formed.
[0019] In order to enable the exchange ink tank 1 and association, while making it penetrate to the opposite side of the head base plate 111 through the hole established in the head PCB 113 and the head base plate 111 in this example, adhesion immobilization of the passage 115 by which the joint closure was carried out to the slot top plate 112 is carried out in the penetration section at the head base plate 111. Moreover, the filter 25 for preventing the inflow of the dust to a discharge part, air bubbles in narrow circumstances, etc. is formed in the edge of the side combined with the ink tank 1 of

passage 115.
[0020] The ink tank for exchange is combined with a recording head 20 by the engagement guide and the pressurization means 103, and when the ink absorber of an ink feed zone touches the filter 25 prepared at the tip of passage 115, association is made mechanically. Ink association is performed to a recording head 20 after association using the recording head suction recovery pump 5015 of the body of a recording device etc. by carrying out supply restoration of the ink compulsorily from the exchange ink tank 1.
[0021] In this example, since a recording head 20 and Carriage HC being mechanical and electrical installation will be made in the same direction while a recording head 20 and the ink tank 1 for exchange are combined at the time of engagement by the pressurization means, positioning with the pad on a head PCB 105 and the head drive electrode 102 is also ensured.
[0022] A little thick elastic body ring constitutes the ring seal from this example so that the backlash of an ink feed zone can be permitted and a joint with an exchange ink tank outer wall can be taken width.
[0023] As explained above, while ensuring positioning with the easy configuration with carriage and a recording head, since it was made to equip carriage after combining a recording head and an exchange ink tank simply out of a body, exchange actuation was able to be made easy at this example by energizing an exchange ink tank, after fully combining the exchange ink tank 1 and a recording head 20. Moreover, since it constituted from this example so that electrical installation of carriage (body of a recording device) and a recording head might also be performed to coincidence, the operability at the time of exchange of a recording head and an exchange ink tank is good, and it is also good to make high the configuration degree of freedom for making electrical installation into a connector connection type etc. separately, and making association with positioning of a recording head, and an exchange ink tank into a more positive thing.
[0024] Here, in order to explain the arrangement and actuation of a recording head in the ink jet recording device in this example, drawing 4 of a printing posture is used every width, and actuation of a recording device is explained. By drawing 4 , a record medium P is guided upwards from a space lower part using the plan ten roller 5000, and it presses to the plan ten 5000 covering the carriage migration direction with the paper presser-foot plate 5002. Carriage HC inserts a carriage migration pin in the spiral sulcus 5004, and reciprocates right and left along with the recording surface of the record medium P which support engagement was carried out and was guided on the plan ten roller 5000 at the slider 5003 arranged in parallel with the leading screw 5005 and leading screw which operate as a driving source because itself rotates. Through the drive transfer gears 5011 and 5009, a leading screw 5005 is interlocked with the forward inverse rotation of a drive motor, and rotation drive control is carried out. 5007 and 5008 are the home-position detection means for checking existence [ in this region of the lever 5006 of carriage ] with a photo coupler, and performing a hand-of-cut change-over of a motor 5013 etc.
[0025] An image recording signal measures timing to migration of the carriage which carries a recording head, is sent to a recording head, and records by making an ink droplet breathe out by the position. 5016 is the member which supports the cap member 5022 which caps the front face of a recording head, and 5015 is a suction means to attract the inside of this cap, and performs suction recovery of a recording head through the opening 5023 in a cap. 5017 is a cleaning blade, 5019 is a member which makes this blade movable to a cross direction, and these are supported by the body support plate 5018. A

suction means, a blade, etc. do not need to be this gestalt and it cannot be overemphasized that a well-known thing can be applied. Moreover, it is a lever for deciding the timing of suction recovery action, and it moves with migration of the cam 5020 which engages with carriage, and, as for 5012, migration control of the driving force from a drive motor is carried out with a means of communication with a well-known clutch change-over etc. When carriage comes to a home-position side field, these recovery means are constituted so that desired processing can carry out to predetermined timing according to an operation of a leading screw 5005 in those correspondence locations.

[0026] Now, then, the example of the ink tank of this invention is explained to a detail.

[0027] First, the configuration and the principle of operation of the ink tank which serves as a foundation of this invention first are explained.

[0028] (Configuration) As shown in drawing 2 , the body of an ink tank has the opening 2 for connecting with an ink jet recording head, adjoins the negative pressure generating member hold section 4 and this negative pressure generating member hold section which held the negative pressure generating member 3 through a rib 5, and consists of the ink hold section 6 which holds the ink 9 which was open for free passage through the clearance section 8 of the ink tank pars basilaris ossis occipitalis 11.

[0029] (Principle of operation (1)) Drawing 2 is a type section Fig. when the joint member 7 which supplies ink 9 to the ink jet recording head 20 being inserted in the ink tank 1 of this invention, carrying out a pressure welding to the negative pressure generating member 3, and changing into the condition that an ink jet recording device can work. In addition, in order to eliminate the dust in an ink tank, the filter 25 may be installed in the edge of the joint member 7.

[0030] If an ink jet recording apparatus works, ink will be breathed out from the orifice of the ink jet recording head 20, and an ink suction force will occur on the ink tank 1. Ink 9 passes along the clearance section 8 which is between the ink hold section 6 to the rib edge B, and the ink cartridge pars basilaris ossis occipitalis 11, and opens the ink stowage 6 and the negative pressure generating member hold section 4 for free passage with this suction force, is drawn in the joint member 7 through the negative pressure generating member 3, and is supplied to the ink jet recording head 20 to the negative pressure generating member hold section 4. Thereby, except clearance section 8, the pressure inside the sealed ink hold section 6 declines, and differential pressure is produced between the ink hold section 6 and the negative pressure generating member hold section 4. If record continues, the differential pressure will continue a rise, but since the negative pressure generating member hold section 4 is wide opened by atmospheric air with the atmospheric-air free passage hole 13, air goes into the ink hold section 6 through the negative pressure generating member 3 from the clearance section 8 of the rib edge B and the ink cartridge pars basilaris ossis occipitalis 11. At this time, the differential pressure of Hazama of the ink hold section 6 and the negative pressure generating member hold section 4 is canceled. During ink jet record, this actuation is repeated and a certain fixed negative pressure is obtained in an ink cartridge. Moreover, except ink 9 adhering to the wall surface in the ink hold section 6, since the ink 9 in the ink hold section 6 can be used mostly altogether, its ink utilization ratio improves.

[0031] (Principle of operation (2)) Based on the principle of operation (1) of this ink tank mentioned above, the easy model for explaining the principle of operation of this ink tank is shown in drawing 10 , and the more detailed principle of operation (2) is described.

[0032] In drawing 10 , the ink hold section 106 was equivalent to the ink hold section 6,

and ink is contained. 102 and 103-1,103-2 are the capillary tubes which expressed the negative pressure generating member 3 typically from the functional side, and generate negative pressure in an ink tank according to the force of the meniscus. 107 is equivalent to the joint member 7, and is combined with the ink jet recording head which is not illustrated, this field is a part equivalent to the ink feed zone which supplies ink from an ink tank, and is that ink is breathed out from an orifice, and flow Q of ink produces it.
[0033] This drawing is equivalent to the condition of having consumed ink for a while from the ink and the ink hold section in a negative pressure generating member which can be supplied, from the condition that the ink hold section and a negative pressure generating member were enough filled up with ink, and is in the head in the orifice of a recording head, the reduced pressure condition within the ink hold section 106, and the condition with which the capillary tube force of 102 and 103-1,103-2 balanced. If ink supply is made from an ink feed zone, the height of the capillary tube of 103-1,103-2 will hardly change, but will be consumed through 108 by which ink is equivalent to the clearance section 8 from the ink hold section 106. Atmospheric air is incorporated in the ink hold section 106 as air bubbles by the meniscus of the capillary tube of 102 displacing, becoming a cellular configuration, and the meniscus being further torn according to increase of the negative pressure in the ink hold section 106 in that case. While ink distribution of inside [ without changing the height of the capillary tube of 103-1,103-2 by this (i.e., a negative pressure generating member) ] had maintained the balance of internal pressure mostly, without most changing, ink is consumed from the ink hold section 106 by ink supply.
[0034] Namely, if ink supply is made, although change of the volume integral arises as a variation rate of a meniscus with the capillary tube of 102 and a changed part of the surface energy of the meniscus in that case increases the negative pressure of an ink feed zone as a part for pressure loss, only an ink feed zone to the amount Q of ink A meniscus is fractured and it is incorporated by ink hold circles as air bubbles, and at last, by being exchanged in air bubbles and ink, a meniscus also returns and the internal pressure of an ink feed zone is also maintained by predetermined internal pressure according to the capillary tube force of 102.
[0035] Drawing 11 shows signs that the internal pressure in the ink feed zone of the ink tank of this example changes according to the ink amount of supply (consumption). In an initial state ( drawing 14 ), the ink supply from the negative pressure generating member hold section starts as mentioned above. That is, since the ink which exists in the negative pressure generating member hold section is supplied until a meniscus is formed in the ink interior wall lower limit section 8, i.e., the clearance section, the internal pressure of an ink feed zone has occurred like the ink tank of the conventional general absorption object method by balance of the capillary tube force on the top face of ink of the compression ink absorber of negative pressure generating member hold circles (gas-liquid interface), and the own head of ink. If it will be in the condition ( drawing 15 ) that the ink of the negative pressure generating member hold section decreases in number with ink supply (consumption), and a gas-liquid interface is formed in the ink room lower limit section like ****, the ink supply from the ink hold section will start, and while the internal pressure of an ink feed zone comes to be maintained and ink is supplied by the capillary tube force of the compression ink absorber near the ink room lower limit section from the ink hold section, almost fixed internal pressure is held. If ink is consumed further, the ink of the ink hold section is consumed mostly and the liquid ink side of the ink hold section becomes low from the ink interior wall lower limit section ( drawing 16 ) Atmospheric

air is supplied to the ink hold section at a stretch, and the ink hold section is completely open for free passage with atmospheric air. Since some ink which was carrying out the remainder to the ink hold section is absorbed by the compression ink absorber of the negative pressure generating member hold section and the ink of negative pressure generating member hold circles increases, only in the part to which an ink top face (gas-liquid interface) goes up a little, the internal pressure of an ink feed zone changes in the forward direction a little. Furthermore, although the ink of the negative pressure generating member hold section will begin to be again consumed if ink is consumed, since atmospheric air begins to be supplied to ** and a recording head by the ink feed zone, the bottom of a gas-liquid interface serves as a limitation of ink supply from it ( drawing 17 ), and exchange of an ink tank is needed.

[0036] By making some ink flow out of an ink tank, while removing the air bubbles in the ink passage which performs suction recovery with the suction means of the above-mentioned body of a recording device at the time of association to a recording head, and is generated in examination of this invention person at the time of association It is possible from the first stage to maintain the stable ink internal pressure, when consuming the ink of the negative pressure generating member hold section just before the first stage and exchange, it is satisfactory to a recording characteristic in any way at the ink adequate supply period shown in drawing 11 , and good record was able to be performed.

[0037] The mechanism described above showed that there was the important following point in order to supply ink.

[0038] It is the thing of the clearance section 8 for which it is stabilized very much in near and the meniscus of ink and atmospheric air needs to be formed. Otherwise, ink must be supplied until it makes internal pressure of an ink feed zone into quite large negative pressure, in order to carry out the variation rate of the meniscus and to move it to the ink hold section. If it becomes so, it will become disadvantageous, in order for the drive with high frequency to become difficult and to perform high-speed printing.

[0039] Drawing 11 does not show signs that the internal pressure in the ink feed zone of this ink tank explained previously changes according to the ink amount of supply (consumption), and shows the so-called static negative pressure in the condition of not performing ink supply, and the so-called dynamic negative pressure in the condition of performing ink supply.

[0040] the meniscus which is the pressure loss at the time of the difference of dynamic negative pressure and static negative pressure supplying ink in this drawing, and was explained previously -- a ratio with the big negative pressure produced in the case of a variation rate is closed.

[0041] Therefore, it is the point of this invention to make the meniscus in this part fracture you to be Sumiya, and the means for it is preparing the atmospheric-air installation way which introduces atmospheric air compulsorily near the clearance section 8, and shows that example below.

[0042] It is what showed the 1st example of this invention to <example 1> drawing 3 , and explains to a detail based on this drawing. Although the negative pressure generating members 3 of an ink tank are absorbers, such as urethane foam When this absorber 3 supplies the negative pressure generating member hold section 4, the clearance used as the atmospheric-air installation way 14 is formed between the rib 5 of the negative pressure generating member hold section 4, and an absorber 3. Even near the clearance section 8 of the rib edge B and the ink tank pars basilaris ossis occipitalis 11 It is the configuration in which the atmospheric-air installation way 14 is extended as the

clearance section. And it is open for free passage with atmospheric air through atmospheric-air free passage opening. For this reason, if it begins to supply ink 9 from the ink feed zone 2, a certain amount of ink will be consumed from an absorber 3, if the internal pressure of the ink feed zone 2 reaches predetermined negative pressure, an ink side as shown in drawing 3 will be stabilized and formed into an absorber 3, and a meniscus will be formed by Hazama of ink and atmospheric air near the clearance section 8. And if it resulted in this condition, since it was stabilized without making pressure loss **P into a not much big value as a result of being able to make the meniscus in the clearance section 8 fracture immediately and ink was supplied by supply of subsequent ink 9, moreover, high-speed printing was attained [ that regurgitation stability is good and ].

[0043] The own capillary tube force (or meniscus force in an ink-negative pressure generating member interface) of a negative pressure generating member etc. is discovered at the time of un-recording, and it controls that ink leaks from an ink jet recording head.

[0044] In addition, since the ink tank 1 of this invention is corresponded to a color ink jet recording apparatus, it can be used, respectively, being able to hold the ink of each color (for example, black, yellow, a Magenta, four colors of cyanogen) in the ink tank according to individual. Moreover, it is good also as an exchange mold ink cartridge which was made to unify the ink cartridge according to individual, and separated the exchange mold ink cartridge good also as an ink tank or for black ink with high operating frequency, and other color ink unification exchange cartridges. Such combination is arbitrary according to ink jet equipment.

[0045] This invention is explained more below at a detail.

[0046] In the ink tank of this invention, in order to control the negative pressure in an ink jet recording head Selection of the negative pressure generating member 3, a configuration, and a dimension from the first The configuration of the rib edge B, A dimension, the configuration of the clearance section 8 of Hazama of the rib edge B and the ink tank pars basilaris ossis occipitalis 11, It is desirable to optimize the roughness of a dimension, the volume rate of the negative pressure generating member hold section 4 and the ink hold section 6, the amount of insertion to the ink tank of the joint member 7, a configuration, a dimension, the configuration of a filter 25, a dimension, and an eye, the surface tension of ink, etc.

[0047] If the negative pressure generating member 3 used by this invention has in itself the capacity to hold ink also to a self-weight and a slight vibration of a liquid (ink), a well-known member can be conventionally used for it. for example, it is ****** reticulated about fiber -- the porous body which has a curdy object and a free passage hole is raised. ink holding power, negative pressure generating, etc. -- adjustment -- sponge, such as easy polyurethane foam, is desirable. Since it can adjust especially in the case of form so that it may become a desired porous consistency at the time of form manufacture, it is desirable. In addition, since the decomposition product by heating may be generated, ink physical properties may be changed and it may have a bad influence on record grace when heat compression processing is carried out for form and a porous consistency is adjusted further, processing of washing etc. is needed. Moreover, although the form of a porous consistency according to it is required in order to manufacture the ink cartridge corresponding to various ink jet recording apparatus, it is desirable to cut into the dimension of a request of form material with the specific number of cels (the number of the holes per inch) which has not performed heat compression, to carry out compression insertion at the negative pressure generating member hold section 4, and to

adjust a porous consistency and the capillary tube force.
[0048] In an ink cartridge (ink tank) with the ink hold section 6 of a sealing system (Environmental variation within an ink jet recording apparatus) As opposed to external-environment change (a temperature rise or atmospheric-pressure fall) in the condition of having been loaded into the ink jet recording device The ink 9 which remains in (there is also expansion of ink) and the ink hold section 6 by air expansion of the ink hold section is extruded out of the ink hold section 6, and, as a result, there is possibility of ink leakage generating out of an ink tank. However, in the ink cartridge of this invention, it is desirable to expect the air expansion volume (for a part for ink expansion to also be included although it is small) of the sealing system ink hold section 6 according to the environment condition by which the worst assumption is carried out, and to give a part for the ink movement magnitude from the ink hold section 6 accompanying it beforehand to the negative pressure generating member hold section 4. In addition, if the installation location of the atmospheric-air free passage hole 13 is the upper part [ opening / as an ink feed hopper 2 by the side of the negative pressure generating member hold section 4 / joint ], especially assignment will not be carried out, but in order to separate the flow of the ink in the negative pressure generating member 3 at the time of an environmental variation from joint opening, it is desirable that it is in a location distant from joint opening. Moreover, the number of the atmospheric-air free passage holes 13 and a configuration, magnitude, etc. can be set as arbitration in consideration of evaporation of ink.
[0049] (Ink cartridge independent PD) an ink cartridge -- the time of the independent PD -- setting -- joint opening -- and -- or it is desirable to seal the atmospheric-air free passage hole 13 by a sealant etc., and to prepare for evaporation of ink or the air expansion in an ink cartridge. It is desirable to use the compound-ized barrier material which compound-ized reinforcing materials, aluminium foil, etc., such as compound-izing and these and paper of the barrier of a simple substance layer and the plastic film of several layers which are called a barrier material in the package field as a sealant, and cloth. It is more desirable by making the ink cartridge body quality of the material and the same quality of the material into the glue line of a barrier material, and welding with heat etc. to raise sealing nature.
[0050] Moreover, in order to control evaporation of the ink from an ink cartridge, or the inflow of the air from external atmospheric air, after inserting an ink cartridge, it is effective if the package gestalt sealed after deaerating the air in an wrapping material is taken. It is desirable to choose from a barrier material like the above-mentioned sealant in consideration of gas transmittance and liquid transmittance as an wrapping material.
[0051] By choosing the above package gestalten, the ink cartridge independent PD does not have ink leakage etc., and becomes what has very high dependability.
[0052] (The manufacture approach) Although an ink cartridge body material may be what kind of ingredient conventionally used for mold goods, it is necessary to choose it from an ingredient which does not have the effect on the ink for ink jets, or the member processed so that it might be uninfluential. Moreover, it is also necessary to take the productivity of an ink cartridge into consideration. For example, an ink cartridge body is divided into ink cartridge pars-basilaris-ossis-occipitalis 11 part and its upper part, each is really fabricated with a resin ingredient, after inserting the negative pressure generating member 3, ink cartridge pars-basilaris-ossis-occipitalis 11 part and its upper part can be welded, and an ink cartridge body can be manufactured. Since the ink of the ink hold section can be checked by looking from the ink cartridge outside if transparence or a

translucent thing is chosen as a resin ingredient, the replacement stage of an ink cartridge can be judged visually. Moreover, in order to make joining, such as the above-mentioned sealant, easy, it is desirable to prepare heights as shown in drawing. Furthermore, it is also desirable on a design to process a crimp etc. on the external surface of an ink cartridge body.

[0053] restoration of ink -- pressurization and a manometric method -- any -- although -- it can be used. In addition, since other ink cartridge openings are not soiled, it is desirable to prepare ink restoration opening in restoration of ink at either of the tank bodies. As for ink restoration opening after ink restoration, it is desirable to carry out a plug with plastics or a metallic material.

[0054] The configuration and configuration of an ink cartridge can perform various kinds of deformation, without deviating from the range of this invention.

[0055] (in addition to this) This ink tank (cartridge) may be used as an exchange mold, and may be made to unite with a recording head.

[0056] Moreover, when used as an exchange mold, it is desirable to carry out recovery action, such as automatic detection of the exchange tank by the body or suction by the user itself.

[0057] Moreover, although it is needless to say, you may use as an ink jet printer which records on the recording head 20 from which four recording heads were united, and which they consisted of like drawing 18 by combining the exchange ink tank of Bk(black) 1a, C(cyanogen)1b, M(Magenta)1c, and four Y(yellow)1d colors.

[0058] <Example of a comparison> It is shown mixing signs that internal pressure [ in /, for the example of a comparison in this example / the ink feed zone of an ink tank ] changes here according to the ink amount of supply.

[0059] Especially in this ink tank, an atmospheric-air installation way is not prepared but the absorber of an almost uniform pore size distribution is built in at negative pressure generating member hold circles.

[0060] It is in the condition that ink hold circles were mostly filled up with ink like drawing 14 in the state of the first stage, and negative pressure generating member hold circles are also filled up with a certain amount of ink. If ink supply begins from this condition, since the ink from the negative pressure generating member hold section is supplied and the ink top face descends as ink supply progresses although the internal pressure of an ink feed zone has occurred by balance with the head of ink the capillary tube force on the top face of ink of the absorber of negative pressure generating member hold circles (gas-liquid interface), and own, negative pressure increases almost linearly to that height first. It will be in the condition of a of drawing 13 . If it will not be in the condition that a gas-liquid interface (meniscus) is formed in the clearance section which is the lower limit section of an ink room, with ink supply as it is, the negative pressure of an ink feed zone will increase rapidly.

[0061] And by the time the meniscus in the clearance section will be formed, the ink side within an absorber will descend considerably, and an oil level will descend depending on [ section / with a head / joint ] the case.

[0062] If it becomes like this, atmospheric air will be taken in in a recording head, the regurgitation will become unstable, and it will keep in the non-regurgitation very much.

[0063] Moreover, although it does not become such, the internal pressure of an ink feed zone may become still larger like the condition of b of drawing 13 exceeding the fixed negative pressure decided by pore size of the absorber of the clearance section. This is considered that the absorber is in a condition like a model which showed [ although some

are compressed with the wall of the negative pressure generating member hold section, ] the perimeter by drawing 12 exactly since a wall did not exist in the clearance section and it was not compressed, and compressibility was small a little compared with the perimeter.

[0064] This drawing is in the condition which consumed ink from the negative pressure generating member hold section to some extent. When ink is further supplied from this condition, the pore size of an absorber is R2, R3, and R4. R4 [ largest ] in inside The meniscus of a part is R3 and R4. If displacement migration is greatly carried out compared with a part and it comes even near the clearance section succeedingly Since the meniscus force becomes weaker suddenly, atmospheric air is crowded with a meniscus moving even to an ink hold section side, and the meniscus fracturing for the ink hold section. At this time, it is R2. A part to R3, and R4 Ink is consumed for a while also from a part. Pressure loss **P in the case of migration of the meniscus in this case will become comparatively big.

[0065] However, by the vigor in the case of a return, the meniscus fractured once will also be in the high condition of pressure loss as it is for the time being in order to form a meniscus in the place again near the original location.

[0066] And a meniscus is the pore size R1 of the clearance section. Once it repeats the same thing and a meniscus is stabilized in the clearance section until it is stabilized into a part, it is the pore size R1 of the clearance section. Air bubbles go into the ink hold section, and are stabilized until it becomes the decided negative pressure.

[0067] The condition so far is in the condition of drawing 13 -b, and it is in the condition of consuming ink from the both sides of the ink hold section and an absorber. Thus, since pressure loss **P at the time of ink supply also becomes large, a regurgitation property may get worse and high-speed printing may become difficult, without stabilizing the internal pressure in an ink feed zone as mentioned above, if an atmospheric-air installation way is not set up.

[0068] The example of reference was shown in <example 1 of reference> drawing 5 .

[0069] In this example of reference, two ribs 61 were formed inside [ negative pressure generating member hold section 4 ] the screen rib 5. The rib 61 is formed even [ near the clearance section 8 ] from the head-lining part of an ink tank. The part pinched with the absorber 3 with Hazama of a rib serves as the atmospheric-air installation way 14.

[0070] by make it locate above the lower limit B of the screen rib 5 , since the lower limit A of this rib 61 only insert the absorber 3 of a rectangular parallelepiped configuration into the negative pressure generating member hold section 4 and can cover the clearance section 8 with an absorber 3 , it become possible [ consider as the configuration which draw the atmospheric air installation way 14 stabilized simply to near the **** of the clearance section 8 ] . In addition, the absorber 3 intervenes between the contact of the head-lining part of a rib 61, and the atmospheric-air free passage hole 13.

[0071] Since an ink side and a meniscus as it is quick and shown in drawing 5 were formed and exchange of the air bubbles by crisp meniscus fracture and ink was moreover performed by ink supply according to printing when printed using this ink tank, it became possible to be able to perform now little ink supply of pressure loss, to be stabilized and to perform high-speed printing.

[0072] Other configurations of the atmospheric-air installation way 14 were shown in <example 2 of reference> drawing 6 , the rib 61 in the example 1 of reference and the same rib 71 were further increased to it, and the number of the atmospheric-air installation ways 14 was increased to it, and the rib 71 was formed in it also at head

lining of the negative pressure generating member hold section. In addition, the absorber 3 intervenes between the edge of a rib 71 established in the head-lining part, and the atmospheric-air free passage hole 13.
[0073] It became possible to be stabilized and to secure two or more atmospheric-air installation ways 14 from the atmospheric-air free passage opening 13 to near the clearance section 8, by this, and it became possible to be able to perform now little ink supply of pressure loss, to be stabilized and to perform high-speed printing like an example 1 and the example 1 of reference.
[0074] Moreover, even if it forms the atmospheric-air free passage hole 13 in the location distant from the clearance section 8, atmospheric installation becomes possible [ carrying out smoothly ].
[0075] Other examples of reference were shown in <example 3 of reference> drawing 7 .
[0076] In this example, like the examples 1 and 2 of reference, although it is forming a rib 81 in the screen rib 5 and the atmospheric-air installation way 14 is formed The path where the ink 9 which moves to the negative pressure generating member hold section 4 through the clearance section 8 by constituting a rib 81 asymmetrically to the screen rib 5 from the ink hold section 6 flows, It passes along the clearance section 8 from the flow of the ink 9, and the atmospheric-air installation way 14 generated complementary, and there is effectiveness which makes pressure loss for exchange small by making into the individual according to independence the path of the flow of the atmospheric air which enters into the ink hold section 6 to a center line A, respectively.
[0077] By carrying out like this, pressure loss **P for exchange of ink and air bubbles became abbreviation half.
[0078] This became possible from the recording head to perform the regurgitation of ink stabilized more.
[0079] Other modifications of a rib 91 are shown in <example 4 of reference> drawing 8 .
[0080] In the examples 1-3 of reference, although the upper limit of a rib 91 was lengthened even to the wall up side of the negative pressure generating member hold section, in this example, it does not lengthen to there but is considering as the short thing.
[0081] By carrying out like this, with a rib 91, it prevents compressing the upper part of an absorber, and the danger that the meniscus force will occur can be prevented in the compressed part, and control of negative pressure can be made into what was stabilized more.
[0082] Furthermore, the ink in an absorber is consumed until it shifts to the stable liquid ink side in detail from the liquid ink side in the absorber which is the negative pressure generating member 3 in the early ink tank by which ink is consumed. Namely, since consumption of the ink from an absorber 3 will decrease as a result of consuming ink from the ink hold section 6 if the too early vapor-liquid exchange through the atmospheric-air installation way 14 is urged, Since the amount of ink which can be moved to the negative pressure generating member hold section 4 by the ink from the ink hold section 6 is restricted at the time of environmental variations, such as atmospheric-pressure fluctuation, the evil in which the buffer effectiveness over the ink leakage of an absorber 3 is halved occurs. So, in this example, after ink was consumed to some extent in the absorber 3, the atmospheric-air installation way 14 was installed, the liquid ink side in an absorber 3 was controlled, and the buffer effectiveness over ink leakage was heightened so that atmospheric-air installation might be carried out.
[0083] In addition, while the liquid ink side level in an absorber 3 becomes possible [

maintaining stably ] to the atmospheric-air installation way 14 neighborhood and the ink 9 in the ink hold section 6 is consumed, almost fixed negative pressure (water head difference) is made generated. Thereby, the negative pressure to a head can be stabilized and stability of the regurgitation of the ink from a delivery is carried out.
[0084] Other examples of reference are shown in <example 5 of reference> drawing 9 .
[0085] At this example, the atmospheric-air installation way 14 is formed by establishing a slot 100 in a screen rib.
[0086] Since the strain of the compressibility of the absorber 3 held in the negative pressure generating member hold section 4 decreases and it is easy to carry out control of negative pressure, it is stabilized and ink can be supplied.
[0087] Other examples of reference are explained to <example 6 of reference> drawing 19 .
[0088] As a configuration, although it is almost the same as the example 5 of reference, a different place is that the atmospheric-air installation way 14 has composition from which it attached and escaped to the rib lower limit B.
[0089] The ink in an absorber is consumed until it shifts to the liquid ink side by which the height of the upper limit section C of the atmospheric-air installation way 14 was stabilized like the examples 4 and 5 of reference from the liquid ink side in the absorber 3 in the early ink tank by which ink is consumed. Although the ink 9 of the ink hold section 6 is consumed performing vapor-liquid exchange through the atmospheric-air installation way 14 after that, since the atmospheric-air installation way has stuck and fallen out to the rib lower limit B, it becomes the behavior which can be considered as a model like drawing 20 .
[0090] A model is used for below and it explains to a detail.
[0091] If the absorber 3 which is a negative pressure generating member is typically expressed from a functional side, it will be considered a capillary tube like drawing 20 , and it is thought that the atmospheric-air installation way 14 is connected from the part of the upper limit section C to the rib lower limit B, and the atmospheric-air installation way 14 is again connected with the capillary tube with the part of the upper limit section C to the up side.
[0092] As stated also in advance, the liquid ink side in an absorber 3 has a certain amount of height in the early ink tank by which ink is consumed, but gradually, the oil level falls and the internal pressure (negative pressure) in the ink feed zone 6 becomes large according to it as ink is consumed.
[0093] And if ink is consumed to the height of the part of the upper limit section C which is the upper limit of the atmospheric-air installation way 14, the liquid ink side will form the meniscus in the location of D in a capillary tube. Furthermore, if ink is received and consumed, a liquid ink side, i.e., a meniscus, will descend again, but if it comes to the location of E, since the meniscus force of the liquid ink side in the atmospheric-air installation way 14 becomes weaker rapidly, in order to consume the ink in the atmospheric-air installation way 14 at a stretch, after that, it will be this location and the ink of the ink hold section will come to be consumed. That is, vapor-liquid exchange comes to be performed. Therefore, during ink consumption, since [ of the height of the upper limit section C ] it is stabilized only in the downward location C, as for the internal pressure in the ink feed zone 6, a liquid ink side goes into a stable zone. And if ink supply stops, the meniscus in a capillary tube will carry out return stability again from the location of E in the location of D.
[0094] Thus, the liquid ink side in an absorber 3 goes back and forth between D and E

until it consumes all the ink of the ink hold section 6.
[0095] And after that, in order to consume the ink in an absorber 3, again, the internal pressure (negative pressure) of the ink feed zone 2 increases, and serves as an ink piece.
[0096] By the way, since the internal pressure in the ink feed zone 6 is obtained from the capillary tube force (that is, an absorber is equivalent to the height which can suck up ink) of an absorber 3 as a difference for height of the liquid ink side in an absorber 3, if it is considered from it being necessary to the ink feed zone 2 to set up the height of the upper limit section C highly, it needs to make pore size of an absorber 3 to some extent small.
[0097] When it is clear and a liquid ink side becomes low from the ink feed zone 2, in order that the reason for setting up the height of the upper limit section C highly to the ink feed zone 2 may take in atmospheric air and may cause the poor regurgitation, it is for preventing it.
[0098] Moreover, it is not good to make it reverse not much high. That is, it is internal pressure change in an ink tank by the environmental variation, and is for the room of the buffer at the time of ink overflowing from the ink hold section 6 to an absorber 3 side to decrease. Then, the volume of the absorber 3 upper section is set as one half extent of the volume of the ink hold section 6 from the height of C.
[0099] The mechanism which gave [ above-mentioned ] explanation is described still more simply.
[0100] That is, supposing an absorber 3 is a uniform consistency, the internal pressure (negative pressure) in the ink feed zone 2 will be decided by the difference of the height H2 by which ink is already sucked up from the height of the ink feed zone 2, H1-H2 [ i.e., ], from the height H1 which can be sucked up from the capillary tube force of an absorber 3, i.e., the height of the ink feed zone 2.
[0101] That is, the force of pulling up the ink of an absorber 3, for example is H1=60mm, and if the height of the part of C of the atmospheric-air installation way 14 is H2=15mm from the ink feed zone 2, the internal pressure of an ink feed zone will serve as H1-H2=60mm-15mm, and will serve as 45mmAq(s).
[0102] Therefore, internal pressure (negative pressure) falls in the linear mostly as ink 9 is consumed from an absorber 3 the first stage and the height of the oil level falls.
[0103] If the ink tank of a configuration of having explained above is used, ink supply by the stable negative pressure can be performed.
[0104] Moreover, since the configuration of the ink tank itself was also easily created with a mold etc., it became possible [ creating at a low price in large quantities ].
[0105] Ink is consumed further. The oil level in an absorber 3 next, to the place of the atmospheric-air installation way 14 Namely, since the ink in the atmospheric-air installation way 14 stops being able to carry out meniscus maintenance when it comes to the place of the upper limit section C (i.e., if a liquid ink side will be in the condition of E of drawing 20 ), It is absorbed at an absorber 3 side, an atmospheric path is formed, vapor-liquid exchange by atmospheric-air installation is performed at a stretch, on the other hand, an oil level will be in the condition of D because the oil level of an absorber 3 goes up again in the ink absorbed at the absorber 3 side, and vapor-liquid exchange stops. In this condition, all over the atmospheric-air installation way 14, there is no ink and the absorber 3 on the atmospheric-air installation way 14 which wrote as a model Fig. has already functioned as a valve simply. Here, it has the composition that the negative pressure generating member intervened between the upper limit section C of the atmospheric-air installation way 14, and the atmospheric-air free passage hole 13.

[0106] Therefore, if ink is again consumed in this condition, in order that the oil level of an absorber 3 may fall for a while, therefore a valve may open, Since vapor-liquid exchange will stop if it comes to the location of D although the oil level of an absorber 3 goes up according to the capillary tube force of an absorber if vapor-liquid exchange is performed at a stretch, the ink by the side of the ink hold section 6 comes to be consumed and ink consumption is completed, an oil level will be stabilized in the location.
[0107] Thus, a liquid ink side is stabilized and can be controlled by the height of the atmospheric-air installation way 14, i.e., the height of the upper limit section C, and if it adjusts beforehand, the capillary tube force of an absorber 3, i.e., the raising height of ink, will become possible [ controlling the internal pressure of the ink feed zone 2 simply ].
[0108] Moreover, in order to hold the ink with which it overflows to an absorber side from the ink hold section by change of ** in the ink tank by environmental change, ink 9 overflows with enlarging, the capillary tube force, i.e., the ink raising height, of an absorber, from an ink tank, or it prevents the ink feed zone 2 becoming positive pressure by it.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram showing an example of association with a head and an ink tank.
[Drawing 2] It is the schematic diagram showing other examples of the head concerning this invention, and a tank.
[Drawing 3] It is the schematic diagram showing an example of the tank concerning this invention.
[Drawing 4] It is the perspective view showing the outline of a recording device.
[Drawing 5] It is the schematic diagram showing the example of 1 reference of the ink tank concerning this invention.
[Drawing 6] It is the schematic diagram showing other examples of reference of the ink tank concerning this invention.
[Drawing 7] It is the schematic diagram showing the example of reference of further others of the ink tank concerning this invention.
[Drawing 8] It is the schematic diagram showing another example of reference of the ink tank concerning this invention.
[Drawing 9] It is the schematic diagram showing still more nearly another example of reference of the ink tank concerning this invention.
[Drawing 10] It is drawing modeling and showing the condition of the ink supply in this invention.
[Drawing 11] It is the property Fig. showing the situation of the internal pressure change by the ink feed zone in this invention.
[Drawing 12] It is drawing modeling and showing the condition of the ink supply in the example of a comparison.
[Drawing 13] It is the property Fig. showing the situation of the internal pressure change by the ink feed zone in the example of a comparison.
[Drawing 14] It is drawing showing the initial state with which ink was filled up in the ink tank.

[Drawing 15] A gas-liquid interface is drawing showing ****** at the beginning of formation.
[Drawing 16] It is drawing showing near the telophase of ink supply.
[Drawing 17] It is drawing showing the condition that ink was supplied.
[Drawing 18] It is the perspective view showing the gestalt which made four heads one and enabled anchoring of an individual tank.
[Drawing 19] It is the schematic diagram showing still more nearly another example of reference of the ink tank concerning this invention.
[Drawing 20] It is drawing modeling and showing the condition of the ink supply in drawing 19 .

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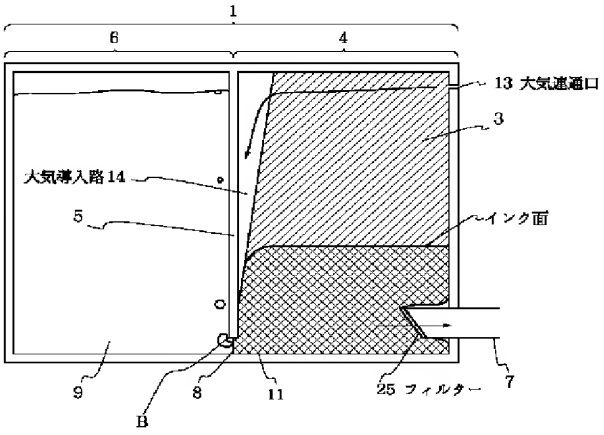
最終頁に続く

(54)【発明の名称】　液体収納容器

(57)【要約】
【課題】　記録に用いられる液体としてのインクのヘッドへの供給をスムーズに安定して行なわせる液体収納容器を提供する。
【解決手段】　負圧発生部材収納室と、連通路を介して連通された液体収納室とを備えた液体収納容器の大気導入路を負圧発生部材が負圧発生部材収納室の内壁から離れることで形成される隙間として構成する。



【特許請求の範囲】
【請求項１】　大気と連通する大気連通部と、液体噴射ヘッドに液体を供給するための液体供給部とを備え、内部に負圧発生部材を収納した負圧発生部材収納室と、
前記負圧発生部材収納室と連通路を介して連通するとともに、前記連通路を除いて実質的に密閉である液体収納室と、を有する液体噴射ヘッド用の液体収納容器であって、
前記液体の消費過程で前記負圧発生部材中の液面高さを前記連通路よりも上方に維持した状態で前記連通路における気液交換を可能にするための前記液体収納室への大気導入可能な大気導入路を前記負圧発生部材が前記負圧発生部材収納室内壁から離れることで形成される隙間として構成されていることを特徴とする液体収納容器。
【請求項２】　前記液体供給部と前記大気連通部とは、物流時には１部材によるシールがなされていることを特徴とする請求項１に記載の液体収納容器。
【請求項３】　前記液体収納容器は内部が視認可能な材料で構成されていることを特徴とする請求項１に記載の液体収納容器。
【請求項４】　前記液体収納容器内には画像形成に寄与する液体が収納されていることを特徴とする請求項１に記載の液体収納容器。
【請求項５】　前記負圧発生部材は、熱圧縮処理を施していないスポンジであり、該熱圧縮処理を施していないスポンジを圧縮して前記負圧発生部材収納室内に収納していることを特徴とする請求項１に記載の液体収納容器。
【請求項６】　前記負圧発生部材は、熱圧縮処理を施したスポンジであることを特徴とする請求項１に記載の液体収納容器。
【請求項７】　前記大気連通部と前記大気導入路の上端とを結ぶ経路には前記負圧発生部材が介在していることを特徴とする請求項１に記載の液体収納容器。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、液体噴射ヘッドに供給する液体を貯留した液体収納容器に関し、特に前記液体噴射ヘッドに対する安定した負圧を提供可能な構成の液体収納容器に関する。
【０００２】
【従来の技術】従来、インクジェット記録装置用の液体噴射ヘッド（以下、記録ヘッドともいう。）に液体（以下、インクともいう。）を供給する液体収納容器（以下、インクタンクともいう。）としては、大きく分類して次の２つが挙げられる。
【０００３】１つは、インクタンクがインクジェット記録装置本体内に内蔵され、インクタンクからインク供給管等を本体内にはい回して記録ヘッドに結合させインクを供給する方式がある。
【０００４】この方式は、インクの供給系が大きなものとなり、装置本体の小型化、低コスト化は難しい。また、供給系でのインクがとぎれやすく、吐出信頼性を上げるための吐出回復系（機構）が、大がかりなものとなり、やはり、装置の小型化、低コスト化の達成が難しいばかりか、回復に要するインク消費量も多量となるため、廃インクの処理の問題、ひいてはランニングコストの増大につながる。
【０００５】しかしながら、記録ヘッドのインク吐出部で、安定したメニスカスを維持させるための方法は、記録ヘッドの位置に対して、インクタンクを下方に取り付けることで達成することができ、簡単かつ、安定した負圧を記録ヘッドのインク吐出口部に発生させられる。
【０００６】２つ目は、インクタンク内全体に負圧発生部材として吸収体を収納し、その吸収体によってインクを保持し、かつ、記録ヘッドのインク吐出口部で安定したメニスカスを維持させるインクタンクがある。この全吸収体インクタンク方式は、吸収体が最大保持可能なインク量よりもやや少ないインクを保持させて、大気連通部側の吸収体内部にメニスカスを発生させることにより、インク供給部で所定の内部負圧を発生させているので、インクタンクの毛細管力を大気連通部側の吸収体内部のメニスカスと記録ヘッドの吐出部とのインク水頭差を考慮して調整しておくことにより、記録ヘッドの吐出部での安定したメニスカスを維持することが可能であり、安定したインクの吐出が可能である。しかしながら、従来公知の全吸収体インクタンク方式は、インクタンク容積に対する保持可能なインク量（インク保持比率）が少なく、インクタンクが記録ヘッドとともに記録紙に対向して記録走査することを考えると、記録装置本体の小型化や、ランニングコストの低減化の上で改善する課題となっていた。特に、印字姿勢可変型のインクジェット記録装置では小型化が重要な要素であり、安定した内部負圧を発生でき、かつ、インク保持比率の高い方式が必要となっている。
【０００７】一方、特開昭５６－６７２６９号公報、あるいは特開昭５９－９８８５７号公報には、インクタンク内にバネで付勢したインク袋を用いたバネ袋インクタンク方式が開示されている。バネ袋方式はバネ力を用いてインク供給部での内部負圧を安定して発生させている点で優れているが、所定の内部負圧を得るためのバネ形状の制約や、インクタンクに袋を固定する工程がやや複雑になり製造コストが高いこと、さらには薄型のインクタンクではインク保持比率が小さくなるなどの問題点も多い。
【０００８】また、特開平０２－２１４６６６号公報には、インクタンク内を複数のインク室に区切り、互いに負圧発生可能な細孔で互いに連通させた区分インク室インクタンク方式が開示されている。本件開示の区分インク室方式はインク室を互いに連通させている細孔の毛細

管力によってインク供給部での内部負圧を発生させている方式である。区分インク室方式はバネ袋方式に比べてインクタンクの構成が簡略化できるので製造コストの面で有利であることと、インクタンクの形状に機構的な制約が少ない点で有利である。しかしながら、上述件開示の区分インク室方式ではインクタンクの保持姿勢を変えるとインク残量によっては細孔部のインクがない状態となることがあり、細孔による内部負圧が不安定となりインク漏れが発生する場合もあり、インクタンク取り扱い上の制約が大きい。

【０００９】

【発明が解決しようとする課題】本発明は、以上のように各種のインクタンク形態における技術課題を改善しようとなされたものであって、区分インク室インクタンク方式を改良して、取り扱い性の優れた、インク保持比率の高い、かつ環境変化に対して、インク漏れのない、かつ、負圧特性を安定化させて、インクの吐出特性に影響を与えずに、記録ヘッドに安定したインク供給を行なうインクタンクの形態を実現することを目的としている。

【００１０】

【課題を解決するための手段】本発明は、前述の目的を達成するために提案されたもので、大気と連通する大気連通部と、液体噴射ヘッドに液体を供給するための液体供給部とを備え、内部に負圧発生部材を収納した負圧発生部材収納室と、前記負圧発生部材収納室と連通路を介して連通するとともに、前記連通路を除いて実質的に密閉である液体収納室と、を有する液体噴射ヘッド用の液体収納容器であって、前記液体の消費過程で前記負圧発生部材中の液面高さを前記連通路よりも上方に維持した状態で前記連通路における気液交換を可能にするための前記液体収納室への大気導入可能な大気導入路を前記負圧発生部材が前記負圧発生部材収納室内壁から離れることで形成される隙間として構成されていることを特徴とする。

【００１１】また、前記液体供給部と前記大気連通部とは、物流時には１部材によるシールがなされている。

【００１２】また、前記液体収納容器は内部が視認可能な材料で構成されている。

【００１３】また、前記液体収納容器内には画像形成に寄与する液体が収納されている。

【００１４】また、前記負圧発生部材は、熱圧縮処理を施していないスポンジであり、該熱圧縮処理を施していないスポンジを圧縮して前記負圧発生部材収納室内に収納している。

【００１５】また、前記負圧発生部材は、熱圧縮処理を施したスポンジであることを特徴とする。

【００１６】また、前記大気連通部と前記大気導入路の上端とを結ぶ経路には前記負圧発生部材が介在している。

【００１７】これにより、大気導入経路を利用してインク供給時に大気を前記連通路に強制的に導入することで、前記連通路におけるメニスカスを安定かつ、すみやかに破断させてインク収容部のインクとの気液交換を良好に行わせる。

【００１８】

【発明の実施の形態】図１は、本発明のインクジェット記録装置の記録ヘッド、インクタンク、キャリッジの結合の状態を示す断面図である。本実施例における記録ヘッド２０は電気信号に応じて膜沸騰をインクに対して生じせしめるための熱エネルギーを生成する電気熱交換体を用いて記録を行なうバブルジェット方式のものである。図１において記録ヘッド２０の主たる構成はすべてヘッドベースプレート１１１に設けた位置決め用の突起１１１－１、１１１－２を位置決め基準としてヘッドベースプレート１１１上に接着ないしは圧着して積層配置されて成る。ここで、図１の面内上下方向はキャリッジＨＣのヘッド位置決め部１０４と突起１１１－２とで位置決めされる。更に、図１の横断図の垂直方向は、突起１１１－２の一部がヘッド位置決め部１０４を覆うように突出し、該突起１１１－２の切り欠き部（不図示）とヘッド位置決め部１０４とで位置決めされる。ヒータボード１１３はＳｉ基板上に複数の列状に配された電気熱変換体（吐出ヒータ）と、これに電力を供給するアルミニウム等の電気配線とが成膜技術により形成されてなり、本体装置からの電気信号を受け取るパッドを端部に配した配線を有するヘッドフレキシブル基板（以下、「ヘッドＰＣＢ」という。）１０５に対して、それぞれの配線を対応させてワイヤボンディングにより接続されている。吐出ヒータに対応して複数のインク流路を各々区分するための隔壁や流路を介して交換インクタンク１からインクを導入してインク流路に供給する共通液室と複数の吐出口を形成するオリフィスとをポリサルフォン等で一体成型した溝天板１１２をヒータボード１１３に不図示のバネで押圧するとともに封止剤を用いて圧着固定及び封止してインク吐出部を形成している。

【００１９】溝天板１１２に結合封止された流路１１５は、交換インクタンク１と結合可能とするために、本実施例においてはヘッドＰＣＢ１１３及びヘッドベースプレート１１１に設けた穴を通ってヘッドベースプレート１１１の反対側へ貫通させるとともに、貫通部でヘッドベースプレート１１１に接着固定されている。また、流路１１５のインクタンク１と結合する側の端部には吐出部へのゴミや不如意の気泡などの流入を防止するためのフィルタ２５が設けてある。

【００２０】交換用インクタンクは係合ガイド及び加圧手段１０３とにより記録ヘッド２０と結合され、インク供給部のインク吸収体が流路１１５の先端に設けたフィルタ２５と接することにより機械的に結合がなされる。結合後、記録装置本体の記録ヘッド吸引回復ポンプ５０１５などを用いて、記録ヘッド２０に交換インクタンク

１から強制的にインクを供給充填することでインク結合を行なう。

【００２１】本実施例では、加圧手段による係合時に記録ヘッド２０及び交換用インクタンク１が結合されるとともに、同一方向で記録ヘッド２０とキャリッジＨＣとが機械的及び電気的接続がなされることになるので、ヘッドＰＣＢ１０５上のパッドとヘッド駆動電極１０２との位置決めも確実に行なわれる。

【００２２】リングシールはインク供給部のガタを許容できるように交換インクタンク外壁との接合部を広めに取れるように、本実施例ではやや太い弾性体リングで構成している。

【００２３】以上説明したように、本実施例では交換インクタンク１と記録ヘッド２０とを十分に結合させた上で交換インクタンクを付勢することで、キャリッジと記録ヘッドと位置決めを簡単な構成で確実に行なうとともに、記録ヘッドと交換インクタンクとを本体外で簡単に結合した上でキャリッジに装着するようにしたので交換操作を容易にすることができた。また、本実施例では、キャリッジ（記録装置本体）と記録ヘッドとの電気的接続も同時に行うように構成したので、記録ヘッド・交換インクタンクの交換時の操作性も良好であるが、電気的接続を別途コネクタ接続方式などにして、記録ヘッドの位置決めと交換インクタンクとの結合をより確実なものとするための構成自由度を高くするのも良い。

【００２４】ここで、本実施例におけるインクジェット記録装置における記録ヘッドの配置及び動作を説明するために、横置き印字姿勢の図４を用いて記録装置の動作を説明する。図４で、記録媒体Ｐをプランテンローラ５０００を用いて紙面下方から上方へ案内し、紙押さえ板５００２でキャリッジ移動方向にわたってプランテン５０００に対して押圧する。キャリッジＨＣは、キャリッジ移動ピンをそのらせん溝５００４にはめ込んで、それ自身が回転することで駆動源として動作するリードスクリュー５００５とリードスクリューに平行に配置されたスライダ５００３とに支持係合されてプランテンローラ５０００上に案内された記録媒体Ｐの記録面に沿って左右に往復動する。リードスクリュー５００５は駆動伝達ギア５０１１、５００９を介して駆動モータの正逆回転に連動して回転駆動制御される。５００７、５００８はフォトカプラでキャリッジのレバー５００６のこの域での存在を確認してモータ５０１３の回転方向切換等を行なうためのホームポジション検知手段である。

【００２５】画像記録信号は、記録ヘッドを搭載するキャリッジの移動にタイミングを計って記録ヘッドに送られ、所定の位置でインク滴を吐出させて記録を行なう。５０１６は記録ヘッドの前面をキャップするキャップ部材５０２２を支持する部材で、５０１５はこのキャップ内を吸引する吸引手段で、キャップ内開口５０２３を介して記録ヘッドの吸引回復を行なう。５０１７はクリーニングブレードで、５０１９はこのブレードを前後方向に移動可能にする部材であり、本体支持板５０１８にこれらは支持されている。吸引手段、ブレード等は、この形態でなくとも良く、周知のものが適用可能なことはいうまでもない。また、５０１２は、吸引回復動作のタイミングを決めるためのレバーで、キャリッジと係合するカム５０２０の移動に伴って移動し、駆動モータからの駆動力がクラッチ切換等の公知の伝達手段で移動制御される。これらの回復手段は、キャリッジがホームポジション側領域にきたときにリードスクリュー５００５の作用によって、それらの対応位置で所望の処理が所定のタイミングで行なえるように構成されている。

【００２６】さてそれでは、本発明のインクタンクの実施例を詳細に説明する。

【００２７】まず、初めに本発明の基礎となるインクタンクの構成及び動作原理を説明する。

【００２８】（構成）図２に示すように、インクタンクの本体は、インクジェット記録ヘッドと連結するための開口部２を持ち、負圧発生部材３を収容した負圧発生部材収容部４と該負圧発生部材収容部にリブ５を介して隣接し、インクタンク底部１１の隙間部８を介して連通したインク９を収容するインク収容部６とからなる。

【００２９】（動作原理（１））図２は、本発明のインクタンク１にインクジェット記録ヘッド２０へインク９を供給するジョイント部材７が挿入され、負圧発生部材３に圧接してインクジェット記録装置が稼動可能な状態になったときの模式断面図である。尚、ジョイント部材７の端部にはインクタンク内のゴミを排除するためにフィルター２５が設置されている場合もある。

【００３０】インクジェット記録装置が稼動するとインクジェット記録ヘッド２０のオリフィスからインクが吐出され、インクタンク１にインク吸引力が発生する。インク９はこの吸引力によりインク収容部６からリブ端部Ｂとインクカートリッジ底部１１との間であって、インク収納部６と負圧発生部材収容部４とを連通する隙間部８を通り、負圧発生部材収容部４へ、負圧発生部材３を通ってジョイント部材７内に引き込まれインクジェット記録ヘッド２０へ供給される。これにより隙間部８以外は密閉しているインク収容部６の内部の圧力が低下し、インク収容部６と負圧発生部材収容部４との間に圧力差を生じる。記録が継続すると、その圧力差は上昇を続けるが、負圧発生部材収容部４は大気連通孔１３により大気に開放されているため、空気は負圧発生部材３を通ってリブ端部Ｂとインクカートリッジ底部１１との隙間部８からインク収容部６に入る。この時点で、インク収容部６と負圧発生部材収容部４との間の圧力差が解消される。インクジェット記録中はこの動作が繰り返され、ある一定の負圧がインクカートリッジ内に得られる。また、インク収容部６内のインク９は、インク収容部６内の壁面に付着するインク９以外は、ほぼ全て使用できる

ためインク使用効率が向上する。

【００３１】（動作原理（２））上述した本インクタンクの動作原理（１）を元に、本インクタンクの動作原理を説明するための簡単なモデルを図１０に示し、より詳細な動作原理（２）を述べる。

【００３２】図１０において、インク収容部１０６は、インク収容部６に相当し、インクが入っている。１０２、１０３－１、１０３－２は負圧発生部材３を機能面から模式的に表わした毛細管であり、そのメニスカスの力により、インクタンク内に負圧を発生させる。１０７はジョイント部材７に相当し、図示されないインクジェット記録ヘッドと結合されており、この領域はインクタンクからインクを供給するインク供給部に相当する部分であり、オリフィスからインクが吐出されることで、インクの流れQが生じる。

【００３３】この図は、インク収容部、負圧発生部材にインクが十分充填された状態から、負圧発生部材中の供給可能なインク及び、インク収容部から、少しインクを消費した状態に相当し、記録ヘッドのオリフィスでの水頭圧とインク収容部１０６内での減圧状態と、１０２、１０３－１、１０３－２の毛細管力が釣り合った状態である。インク供給部から、インク供給がなされると、１０３－１、１０３－２の毛細管の高さはほとんど変化せず、インク収容部１０６からインクが隙間部８に相当する１０８を通り消費される。その際のインク収容部１０６での負圧の増大により、１０２の毛細管のメニスカスが変位して、気泡形状となり、更に、そのメニスカスが破れることで、大気が気泡として、インク収容部１０６内に取り込まれる。これにより１０３－１、１０３－２の毛細管の高さを変化させずに、すなわち負圧発生部材中のインク分布はほとんどが変化せずに、ほぼ内圧の平衡を維持したまま、インク供給分だけ、インク収容部１０６からインクが消費されるのである。

【００３４】すなわち、インク供給部からインク量Qだけ、インク供給がなされると、その体積分の変化が１０２の毛細管で、メニスカスの変位として生じ、その際のメニスカスの表面エネルギーの変化分が圧力損失分として、インク供給部の負圧を増大させるのだが、メニスカスが破断されて、気泡としてインク収容部内に取り込まれ、ついに気泡とインクが交換されることで、メニスカスも元に戻って、インク供給部の内圧も、１０２の毛細管力によって所定の内圧に維持されるのである。

【００３５】図１１は、本実施例のインクタンクのインク供給部における内圧がインク供給量（消費量）に応じて変化する様子を示すものである。初期状態（図１４）では、上述のように負圧発生部材収容部からのインク供給が始まる。すなわち、インク室壁下端部、すなわち隙間部８にメニスカスが形成されるまで負圧発生部材収容部に存在しているインクが供給されるので、従来の全吸収体方式のインクタンクと同様に負圧発生部材収容部内の圧縮インク吸収体のインク上面（気液界面）の毛細管力とインク自身の水頭圧とのバランスによってインク供給部の内圧が発生している。インク供給（消費）に伴って負圧発生部材収容部のインクが減少して上述のごとくインク室下端部に気液界面が形成される状態（図１５）となるとインク収容部からのインク供給が始まり、インク室下端部近傍の圧縮インク吸収体の毛細管力によってインク供給部の内圧が維持されるようになり、インク収容部からインクが供給されている間はほぼ一定の内圧を保持する。インクが更に消費されてインク収容部のインクがほぼ消費されてインク室壁下端部よりインク収容部のインク液面が低くなると（図１６）、インク収容部に大気が一気に供給され、インク収容部が大気と完全に連通し、インク収容部に残余していた若干のインクが負圧発生部材収容部の圧縮インク吸収体に吸収されて負圧発生部材収容部内のインクが増量するためインク上面（気液界面）がやや上昇する分だけインク供給部の内圧がやや正方向に変化する。更に、インクが消費されると負圧発生部材収容部のインクが再び消費されはじめるが、インク供給部より気液界面下がると記録ヘッドに大気が供給され始めるのでインク供給の限界となり（図１７）、インクタンクの交換が必要となる。

【００３６】本発明者の検討では、記録ヘッドへの結合時に前述の記録装置本体の吸引手段で吸引回復を行い、結合時に発生するインク流路中の気泡を除去するとともに若干のインクをインクタンクから流出させることで、初期から安定したインク内圧を維持することが可能であり、負圧発生部材収容部のインクを初期及び交換直前に消費する場合においても、図１１に示したインク安定供給期間で記録特性になんら問題はなく、良好な記録が行えた。

【００３７】以上述べたメカニズムにより、インクが供給されるためには、次の重要なポイントがあることが分かった。

【００３８】それは、隙間部８のごく近傍に安定して、インクと大気とのメニスカスが形成されている必要があることである。そうでないと、メニスカスを変位させて、インク収容部まで移動させるために、インク供給部の内圧をかなり大きい負圧にするまで、インクを供給しなければならない。そうなると、高周波数での駆動が難しくなり、高速印字を行うためには不利なものとなる。

【００３９】図１１は先程説明した、このインクタンクのインク供給部における内圧がインク供給量（消費量）に応じて変化する様子を示すものであり、インク供給を行わない状態での、いわゆる静負圧と、インク供給を行っている状態の、いわゆる動負圧を示している。

【００４０】この図における、動負圧と静負圧の差がインクを供給する際の圧力損失であり、先に説明した、メニスカス変位の際に生ずる負圧が大きな比率をしめるものである。

【００４１】よって、この部分におけるメニスカスの破断をすみやかに行わせることが本発明のポイントであり、そのための手段は、大気を隙間部８の近傍に強制的に導入する大気導入路を設けることであり、以下にその実施例を示す。

【００４２】＜実施例１＞図３に本発明の第１の実施例を示したもので、この図をもとに詳細に説明する。インクタンクの負圧発生部材３はウレタンフォーム等の吸収体であるが、この吸収体３が負圧発生部材収容部４に納入した際に、負圧発生部材収容部４のリブ５と吸収体３との間に大気導入路１４となる隙間を形成しており、リブ端部Ｂとインクタンク底部１１との隙間部８の近傍にまで、その隙間部として大気導入路１４が伸びている形状となっている。そして、大気連通口を介して大気と連通している。このためインク供給部２からインク９を供給しはじめると、吸収体３からある程度のインクを消費して、インク供給部２の内圧が所定の負圧に達すると、図３に示すようなインク面を吸収体３中に安定して形成し、隙間部８の近傍でインクと大気の間でメニスカスを形成する。そして、この状態に至ると、その後のインク９の供給により、すぐに隙間部８でのメニスカスの破断を行わせることができる結果、圧力損失△Ｐをあまり大きな値にさせることなく安定してインクを供給することができるため、吐出安定性の良い、しかも高速印字が可能となった。

【００４３】非記録時においては、負圧発生部材自身の毛細管力（あるいはインク－負圧発生部材界面でのメニスカス力）などが発現され、インクジェット記録ヘッドからインクが漏れることを抑制する。

【００４４】尚、本発明のインクタンク１をカラーインクジェット記録装置に対応するために各色（例えばブラック、イエロー、マゼンタ、シアンの４色）のインクをそれぞれ個別のインクタンクに収容して使用することができる。また、個別のインクカートリッジを一体化させてインクタンクとしても良く、あるいは、使用頻度の高いブラックインク用の交換型インクカートリッジと、他のカラーインク一体化交換カートリッジを分離した交換型インクカートリッジとしても良い。これらの組み合わせはインクジェット装置に合わせて任意である。

【００４５】以下に本発明をより詳細に説明する。

【００４６】本発明のインクタンクにおいて、インクジェット記録ヘッドにおける負圧を制御するためには、負圧発生部材３の選定、形状、寸法はもとより、リブ端部Ｂの形状、寸法、リブ端部Ｂとインクタンク底部１１との間の隙間部８の形状、寸法、負圧発生部材収容部４とインク収容部６の容積割合、ジョイント部材７のインクタンクへの挿入量、形状、寸法、フィルター２５の形状、寸法、目の荒さ及びインクの表面張力などを最適化することが好ましい。

【００４７】本発明で使用する負圧発生部材３は、それ自身、液体（インク）の自重及びわずかな振動に対してもインクを保持する能力を有するものであれば従来公知の部材が使用できる。例えば、繊維を網状に綱込んだ綿状体や連通孔を有する多孔質体などがあげられる。インク保持力及び負圧発生などが調整容易なポリウレタンフォームなどのスポンジが好ましい。特に、フォームの場合には、フォーム製造時に所望の多孔密度となるように調整できるので好ましい。尚、フォームを熱圧縮処理をして更に多孔密度を調整した場合には、加熱による分解物が発生し、インク物性を変化させ、記録品位に悪影響を及ぼす場合があるので、洗浄などの処理が必要となる。また、各種インクジェット記録装置に対応したインクカートリッジを製造するためそれに応じた多孔密度のフォームが要求されるが、熱圧縮を施していない特定のセル数（１インチ当りの空孔の数）を持つフォーム材を所望の寸法にカットし、負圧発生部材収容部４に圧縮挿入し、多孔密度、毛細管力を調整することが好ましい。

【００４８】（インクジェット記録装置内での環境変化）密閉系のインク収容部６を持つインクカートリッジ（インクタンク）においては、インクジェット記録装置内に装填された状態での外部環境変化（温度上昇、あるいは気圧低下）に対しては、インク収容部の空気膨張により（インクの膨張もある）、インク収容部６に残存しているインク９をインク収容部６外へ押し出し、その結果インクタンクの外へのインク漏れ発生の可能性がある。しかしながら、本発明のインクカートリッジにおいては、最悪想定される環境状態に応じた密閉系インク収容部６の空気膨張体積（僅かではあるがインク膨張分も含む）を予想し、それに伴うインク収容部６からのインク移動量分を負圧発生部材収容部４にあらかじめ持たせることが好ましい。尚、大気連通孔１３の設置位置は、負圧発生部材収容部４側のインク供給口２としてのジョイント開口部より上部ならば特に指定はしないが、環境変化時の負圧発生部材３中のインクの流れをジョイント開口部から離すために、ジョイント開口部から遠い位置にあるのが好ましい。また、大気連通孔１３の数及び形状、大きさなどはインクの蒸発を考慮して任意に設定することができる。

【００４９】（インクカートリッジ単独の物流）インクカートリッジ単独の物流時においては、ジョイント開口部及び又は、大気連通孔１３をシール材などで密閉してインクの蒸発やインクカートリッジ内の空気膨張に備えることが好ましい。シール材としては、包装分野においてバリヤー材と称される単体層のバリヤー及び数層のプラスチックフィルムの複合化及びこれらと紙、布などの補強材またアルミニウム箔などを複合化した複合化バリヤー材を使用することが好ましい。インクカートリッジ本体材質と同様な材質をバリヤー材の接着層とし、熱などで溶着することによって密閉性を上げることがより好ましい。

【００５０】また、インクカートリッジからのインクの蒸発あるいは、外部大気からの空気の流入を抑制するためには、インクカートリッジを挿入後は包材内の空気を脱気してから密閉する包装形態をとれば効果的である。包材としては、気体透過度及び液体透過度を考慮し、上記シール材同様バリヤー材から選択することが好ましい。

【００５１】上述のような包装形態を選択することによって、インクカートリッジ単独の物流は、インク漏れなどもなく、非常に信頼性の高いものとなる。

【００５２】（製造方法）インクカートリッジ本体材料は、従来成形品に用いられるいかなる材料であってもよいが、インクジェット用インクへの影響がないような材料あるいは、影響がないように処理された部材から選択する必要がある。また、インクカートリッジの生産性を考慮することも必要となる。例えば、インクカートリッジ本体をインクカートリッジ底部１１部分とその上部部分とに分割して樹脂材料にてそれぞれを一体成形し、負圧発生部材３を挿入後、インクカートリッジ底部１１部分とその上部部分を溶着してインクカートリッジ本体を製造することができる。樹脂材料に透明あるいは、半透明なものを選択すればインク収容部のインクはインクカートリッジ外部から視認することができるので、インクカートリッジの取り替え時期を目視にて判断することができる。また、上記シール材などの溶着を容易にするために図のような凸部を設けることが好ましい。更に、インクカートリッジ本体外面にシボなどの加工を施すこともデザイン上好ましい。

【００５３】インクの充填には、加圧及び減圧法いずれもが使用できる。尚、インクの充填にタンク本体のいずれかにインク充填口を設けることは他のインクカートリッジ開口部を汚すことがないので好ましい。インク充填後のインク充填口は、プラスチックあるいは、金属材料にて栓することが好ましい。

【００５４】インクカートリッジの構成及び形状は、本発明の範囲から逸脱することなく各種の変形を行うことができる。

【００５５】（その他）本インクタンク（カートリッジ）は、交換型として使っても良いし、記録ヘッドと一体化させたものであっても良い。

【００５６】また、交換型として使用される場合、本体による交換タンクの自動検知あるいは、ユーザー自身による吸引等の回復動作をすることが好ましい。

【００５７】また、言うまでもないが、図１８のように、４つの記録ヘッドが一体となって構成された記録ヘッド２０に、Ｂｋ（ブラック）１ａ、Ｃ（シアン）１ｂ、Ｍ（マゼンタ）１ｃ、Ｙ（イエロー）１ｄの４色の交換インクタンクを結合させて記録を行うインクジェットプリンターとして使っても良い。

【００５８】＜比較例＞ここで、本実施例における比較例をインクタンクのインク供給部における内圧がインク供給量に応じて変化する様子を交えながら示す。

【００５９】このインクタンク内には、特に大気導入路が設けられておらず、負圧発生部材収容部内には、ほぼ均一なポアサイズ分布の吸収体が内蔵されている。

【００６０】初期の状態では、図１４のようにインク収容部内にはインクがほぼ充填された状態であり、負圧発生部材収容部内にも、ある程度のインクが充填されている。この状態から、インク供給が始まると、まず、負圧発生部材収容部からのインクが供給されるので、負圧発生部材収容部内の吸収体のインク上面（気液界面）の毛細管力とインク自身との水頭圧とのバランスによってインク供給部の内圧が発生しているが、インク供給が進むにつれ、インク上面が降下していくため、その高さに対して、ほぼ直線的に負圧が増大していく。図１３のａの状態となる。このまま、インク供給に伴って、インク室の下端部である隙間部に気液界面（メニスカス）が形成される状態にならないと、インク供給部の負圧はどんどん高まってしまう。

【００６１】そして、隙間部でのメニスカスが形成された状態になるまでに、吸収体内でのインク面は、かなり下降してしまい、場合によってはヘッドとのジョイント部よりも液面が下降してしまう。

【００６２】こうなると、記録ヘッド内に大気をとり込むこととなり、吐出が不安定となり、不吐出に至ってしまう。

【００６３】また、このようにならないまでも、インク供給部の内圧は図１３のｂの状態のように、隙間部の吸収体のポアサイズによって決まる一定の負圧を越えて、更に大きくなる場合もある。これは、吸収体はその周囲を負圧発生部材収容部の内壁によって、多少圧縮されているが、隙間部においては壁が存在しないので、圧縮されていないため、その周囲に比べて圧縮率が若干小さいため、ちょうど図１２で示したモデルのような状態となっていると考えられる。

【００６４】この図は、ある程度、負圧発生部材収容部からインクを消費した状態である。この状態から、更にインクを供給すると、吸収体のポアサイズが$R_2$、$R_3$、$R_4$の中で一番大きい$R_4$の部分のメニスカスが$R_3$、$R_4$の部分に比べて大きく変位移動し、引き続き隙間部の近くにまで来ると、急にメニスカス力が弱まるため、インク収容部側にまでメニスカスが移動して、そのメニスカスが破断することで、大気がインク収容部にとり込まれる。この時には、$R_2$の部分からだけではなく、$R_3$、$R_4$の部分からも少しインクが消費される。この際のメニスカスの移動の際の圧力損失△Ｐは比較的大きなものとなる。

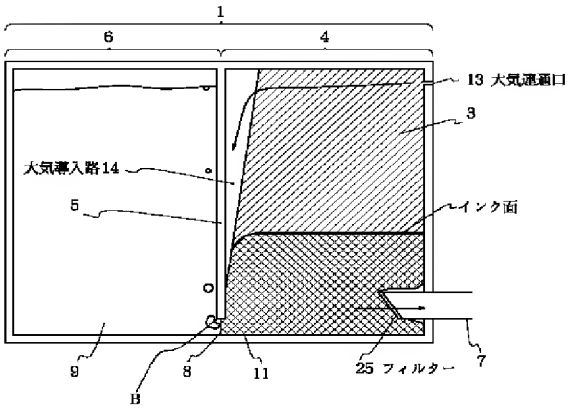
【００６５】しかしながら、一度破断したメニスカスも、復帰の際の勢いにより、再び元の位置に近い所でメニスカスを形成するため、しばらくはこのまま圧力損失

の高い状態となる。
【００６６】そして、メニスカスが隙間部のポアサイズ$R_1$の部分に安定するまで、同様なことを繰り返し、一旦、隙間部でメニスカスが安定すると、隙間部のポアサイズ$R_1$で決まる負圧になるまで気泡がインク収容部に入り安定する。
【００６７】ここまでの状態が図１３－ｂの状態であり、インク収容部及び吸収体の双方からインクを消費している状態である。このように、大気導入路が設定されないと、前記のようにインク供給部における内圧が安定されないで、インク供給時の圧力損失△Ｐも大きくなるため、吐出特性が悪化し、高速印字が難しくなる場合がある。
【００６８】＜参考例１＞図５に、参考例を示した。
【００６９】本参考例においては、ついたてリブ５の負圧発生部材収容部４内側に、２本のリブ６１を設けた。リブ６１はインクタンクの天井部分から隙間部８の近傍にまでわたって設けられている。リブの間と吸収体３で挟まれた部分が大気導入路１４となる。
【００７０】このリブ６１の下端Ａは、ついたてリブ５の下端Ｂよりも上に位置するようにすることで、単に直方体形状の吸収体３を負圧発生部材収容部４内に挿入するだけで、隙間部８を吸収体３でカバーすることができるため、簡単にかつ安定した大気導入路１４を隙間部８の極く近傍まで導く構成とすることが可能となる。尚、リブ６１の天井部分の接点と大気連通孔１３との間は、吸収体３が介在している。
【００７１】このインクタンクを用いて、印字を行ったところ、印字によるインク供給によって、素早く、図５に示すようなインク面及びメニスカスを形成して、しかも、歯切れの良い、メニスカス破断による気泡とインクの交換が行われるため、圧力損失の少ないインク供給が行えるようになり、高速印字を安定して行うことが可能となった。
【００７２】＜参考例２＞図６に、大気導入路１４の他の構成を示し、参考例１におけるリブ６１と同様のリブ７１を更に増して、大気導入路１４の数を増して、かつ、そのリブ７１を負圧発生部材収容部の天井にも設けた。尚、天井部分に設けられたリブ７１の端部と大気連通孔１３との間には吸収体３が介在している。
【００７３】これによって、複数の大気導入路１４を大気連通口１３から、隙間部８の近傍まで安定して確保することが可能となり、実施例１、参考例１同様、圧力損失の少ないインク供給が行えるようになり、高速印字を安定して行うことが可能となった。
【００７４】また、大気連通孔１３を隙間部８から離れた位置に設けても、大気の導入がスムーズに行うことが可能となる。
【００７５】＜参考例３＞図７に、他の参考例を示した。
【００７６】本実施例においては、参考例１、２と同様、ついたてリブ５にリブ８１を設けることで、大気導入路１４を形成しているものであるが、リブ８１をついたてリブ５に対して非対称に構成することにより、インク収容部６から隙間部８を通って負圧発生部材収容部４に移動するインク９の流れる通路と、そのインク９の流れと相補的に発生する、大気導入路１４から隙間部８を通って、インク収容部６に入り込む大気の流れの通路を、中心線Ａに対して、それぞれ独立別個にすることで、入れ換えのための圧力損失を小さくする効果がある。
【００７７】こうすることで、インクと気泡の入れ替えのための圧力損失△Ｐは、約半分となった。
【００７８】これにより、記録ヘッドからより安定した、インクの吐出を行うことが可能となった。
【００７９】＜参考例４＞図８に、リブ９１の他の変形例を示す。
【００８０】参考例１～３では、リブ９１の上端を、負圧発生部材収容部の内壁の上側にまで伸ばしていたが、本実施例では、そこまで伸ばさず短いものとしている。
【００８１】こうすることで、リブ９１によって、吸収体の上部が圧縮されるのを防ぎ、圧縮された部分で、メニスカス力が発生する危険性を防ぎ、負圧のコントロールをより安定したものにすることができる。
【００８２】更に詳しくは、インクが消費される初期のインクタンク中における、負圧発生部材３である吸収体中のインク液面から、安定したインク液面に移行するまでは、吸収体中のインクを消費するようにする。すなわち、大気導入路１４を通した早すぎる気液交換を促すと、インク収容部６からインクが消費される結果、吸収体３からのインクの消費が少なくなってしまうため、気圧変動等の環境変化時に、インク収容部６からのインクが、負圧発生部材収容部４へ移ることが可能なインク量が制限されるため、吸収体３のインク漏れに対するバッファー効果が半減するという弊害が発生する。そこで、本実施例では、インクが吸収体３中で、ある程度消費されてから、大気導入がされるように、大気導入路１４を設置して、吸収体３中のインク液面をコントロールし、インク漏れに対するバッファー効果を高めた。
【００８３】加えて、大気導入路１４付近に吸収体３中のインク液面レベルが安定的に維持することが可能となり、インク収容部６内のインク９が消費される間、ほぼ一定の負圧（水頭差）を発生させることになる。これにより、ヘッドに対する負圧を安定化でき、吐出口からのインクの吐出を安定させられる。
【００８４】＜参考例５＞図９に、他の参考例を示す。
【００８５】本実施例では、大気導入路１４を、ついたてリブに溝１００を設けることで形成する。
【００８６】負圧発生部材収容部４内に収容する吸収体３の圧縮率のひずみが少なくなるため、負圧のコントロ

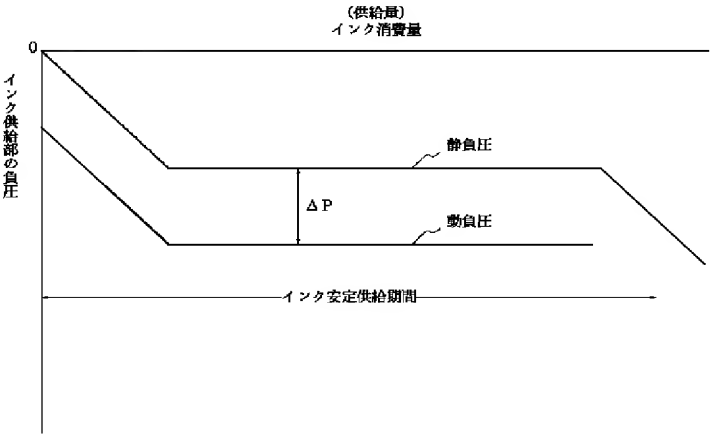
ールがしやすいため、安定してインクを供給できる。
【００８７】＜参考例６＞図１９に他の参考例を説明する。
【００８８】構成としては、参考例５とほぼ同じであるが、異なるところは大気導入路１４はリブ下端Ｂまで、つき抜けた構成となっていることである。
【００８９】参考例４、５と同様に、インクが消費される初期のインクタンク中における吸収体３中のインク液面から、大気導入路１４の上端部Ｃの高さの安定したインク液面に移行するまでは、吸収体中のインクを消費するようにして、その後は大気導入路１４を通して気液交換を行いながら、インク収容部６のインク９を消費していくが、大気導入路がリブ下端Ｂまでつき抜けているため、図２０のようなモデルとして、考えることができる挙動となる。
【００９０】以下にモデルを用いて、詳細に説明する。
【００９１】負圧発生部材である吸収体３を機能面から模式的に表わすと図２０のような毛細管と考えられ、大気導入路１４は上端部Ｃの部分から、リブ下端Ｂまで継っており、大気導入路１４は、上端部Ｃの部分から上側では再び、毛細管と継っていると考えられる。
【００９２】先にも述べたように、吸収体３中のインク液面は、インクが消費される初期のインクタンク中では、ある程度の高さになっているが、インクが消費されるに従って徐々に、その液面が下がっていき、それに従い、インク供給部６における内圧（負圧）は徐々に大きくなっていく。
【００９３】そして、大気導入路１４の上端である、上端部Ｃの部分の高さまで、インクが消費されると、インク液面は毛細管中のＤの位置でメニスカスを形成している。更にインクが受給・消費されると、再びインク液面すなわち、メニスカスが下降するが、Ｅの位置まで来ると、大気導入路１４中のインク液面のメニスカス力は急激に弱まるため、一気に大気導入路１４中のインクが消費されるようになるため、その後、この位置で、インク収容部のインクが消費されるようになる。すなわち、気液交換が行なわれるようになる。よって、インク消費中はインク液面が上端部Ｃの高さのわずか下方の位置Ｃで安定するため、インク供給部６での内圧は安定領域に入るのである。そして、インク供給が停止すると、毛細管中のメニスカスはＥの位置から再びＤの位置に戻り安定する。
【００９４】このように、インク収容部６のインクを全て、消費するまで、吸収体３中のインク液面はＤとＥの間を往復する。
【００９５】そして、その後は吸収体３中のインクを消費するようになるため、再び、インク供給部２の内圧（負圧）は増大していき、インク切れとなる。
【００９６】ところで、インク供給部６における内圧は吸収体３の毛細管力（すなわち、吸収体がインクを吸い上げることができる高さに相当する）から吸収体３中のインク液面の高さ分の差として得られるため、上端部Ｃの高さを、インク供給部２に対して、高く設定する必要があることから考えると、吸収体３のポアサイズをある程度、小さくする必要がある。
【００９７】上端部Ｃの高さをインク供給部２に対して高く設定する理由は明白であり、インク供給部２よりインク液面が低くなると、大気をとり込んでしまって吐出不良を引き起こすためそれを防止するためである。
【００９８】また、逆に、あまり高くすると良くない。すなわち環境変化による、インクタンク内の内圧変化で、インク収容部６から吸収体３側へインクがあふれた際のバッファの余地が少なくなるためである。そこでＣの高さから上の吸収体３部の容積は、インク収容部６の容積の半分程度に設定している。
【００９９】上記説明したメカニズムを更に簡易に述べる。
【０１００】すなわち、吸収体３が一様な密度であるとすると、インク供給部２における内圧（負圧）は、吸収体３の毛細管力、すなわちインク供給部２の高さから吸い上げることができる高さ$H_1$から、インク供給部２の高さからすでにインクが吸い上げられている高さ$H_2$の差すなわち$H_1-H_2$によって決まるのである。
【０１０１】すなわち、例えば吸収体３のインクを引き上げる力が$H_1$＝６０ｍｍで、インク供給部２から大気導入路１４のＣの部分の高さが$H_2$＝１５ｍｍであれば、インク供給部の内圧は$H_1-H_2$＝６０ｍｍ－１５ｍｍとなり４５ｍｍＡｑとなるのである。
【０１０２】よって初期は、吸収体３からインク９が消費されるに従いその液面の高さが下がるに従い、ほぼリニアに内圧（負圧）は下がっていくのである。
【０１０３】以上説明した構成のインクタンクを用いれば、安定した負圧によるインク供給を行うことができる。
【０１０４】また、インクタンク自体の構成も、型等で容易に作成することができるため大量に安く作成することが可能となった。
【０１０５】次に更にインクが消費され吸収体３中の液面が大気導入路１４の所まで、すなわち上端部Ｃの所まで来ると、すなわち、インク液面が図２０のＥの状態になると大気導入路１４中のインクはメニスカス保持できなくなるため、吸収体３側に吸収され大気の通路が形成され一気に大気導入による気液交換が行なわれ、一方、吸収体３側に吸収されたインクにより吸収体３の液面が再び上昇することで液面がＤの状態となり、気液交換が停止する。この状態では、大気導入路１４中にはすでにインクはなく、モデル図として書いた大気導入路１４の上の吸収体３は、単純に弁として機能しているのである。ここで、大気導入路１４の上端部Ｃと大気連通孔１３との間には負圧発生部材が介在した構成となってい

る。
【０１０６】よって、この状態で再びインクが消費されれば、吸収体３の液面が少し下がり、そのため弁が開くことになるため、一気に気液交換が行なわれインク収容部６側のインクが消費されるようになり、インク消費が終了すれば、吸収体３の液面が、吸収体の毛細管力によって上昇するが、Ｄの位置まで来ると気液交換が停止するため、その位置で液面が安定することになるのである。
【０１０７】このように、インク液面は大気導入路１４の高さ、すなわち、上端部Ｃの高さによって安定して制御でき、かつ、吸収体３の毛細管力、すなわち、インクの引き上げ高さはあらかじめ調整すれば、簡易にインク供給部２の内圧を制御することが可能となるのである。
【０１０８】また、環境の変化によるインクタンク内の圧の変化によって、インク収容部から、吸収体側へあふれるインクを保持するために、吸収体の毛細管力、すなわち、インク引き上げ高さを大きくしておくことで、インク９がインクタンクからあふれたり、インク供給部２が正圧になるのを防ぐのである。
【０１０９】
【発明の効果】以上説明してきたように、本発明では、インク供給時にインク収容部中のインクと大気とが、安定かつ、すみやかに気液交換されることが可能となり、その結果、インク供給部における内圧を安定して制御することが可能となり、記録ヘッドにおける吐出安定性の良い、しかも、高速印字が可能となった。
【０１１０】また、外部環境の変化に対する、インクタンク内の圧力変化に対しても、インク漏れが発生することのない、インクタンクを提供することが可能となった。
【図面の簡単な説明】
【図１】ヘッドとインクタンクとの結合の一例を示す概略図である。
【図２】本発明にかかるヘッドとタンクの他の例を示す概略図である。
【図３】本発明にかかるタンクの一例を示す概略図である。
【図４】記録装置の概略を示す斜視図である。
【図５】本発明にかかるインクタンクの一参考例を示す概略図である。
【図６】本発明にかかるインクタンクの他の参考例を示す概略図である。
【図７】本発明にかかるインクタンクのさらに他の参考例を示す概略図である。
【図８】本発明にかかるインクタンクの別の参考例を示す概略図である。
【図９】本発明にかかるインクタンクのさらに別の参考例を示す概略図である。
【図１０】本発明におけるインク供給の状態をモデル化して示す図である。
【図１１】本発明におけるインク供給部での内圧変化の様子を示す特性図である。
【図１２】比較例におけるインク供給の状態をモデル化して示す図である。
【図１３】比較例におけるインク供給部での内圧変化の様子を示す特性図である。
【図１４】インクタンク内にインクが充填された初期状態を示す図である。
【図１５】気液界面が形成始めた状態を示す図である。
【図１６】インク供給の終期付近を示す図である。
【図１７】インクが供給された状態を示す図である。
【図１８】４つのヘッドを一体とし個別タンクを取付け可能とした形態を示す斜視図である。
【図１９】本発明にかかるインクタンクのさらに別の参考例を示す概略図である。
【図２０】図１９におけるインク供給の状態をモデル化して示す図である。

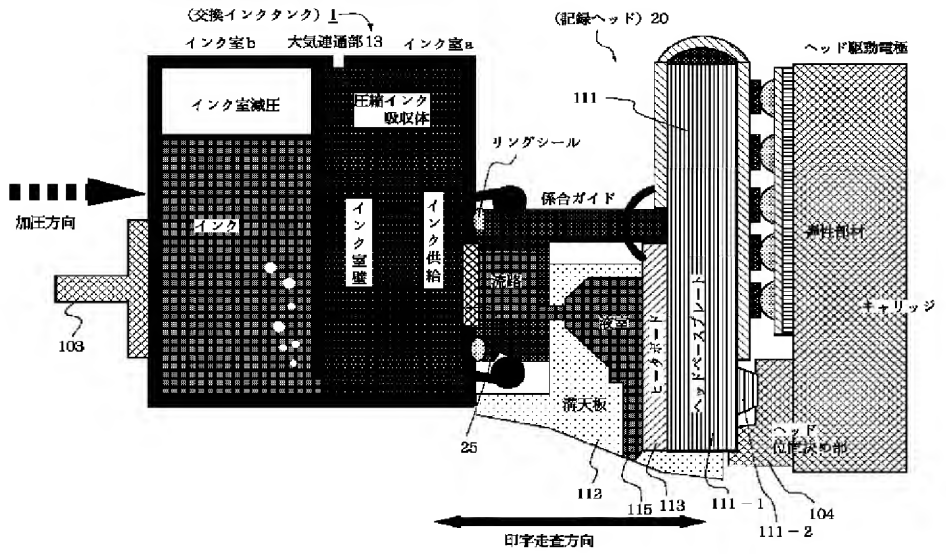
【図３】



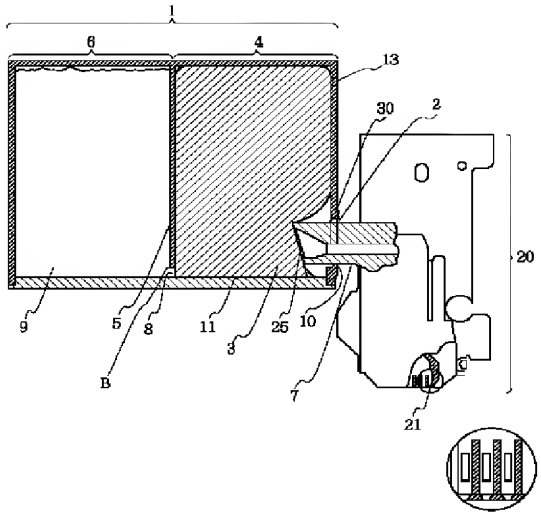

【図１１】



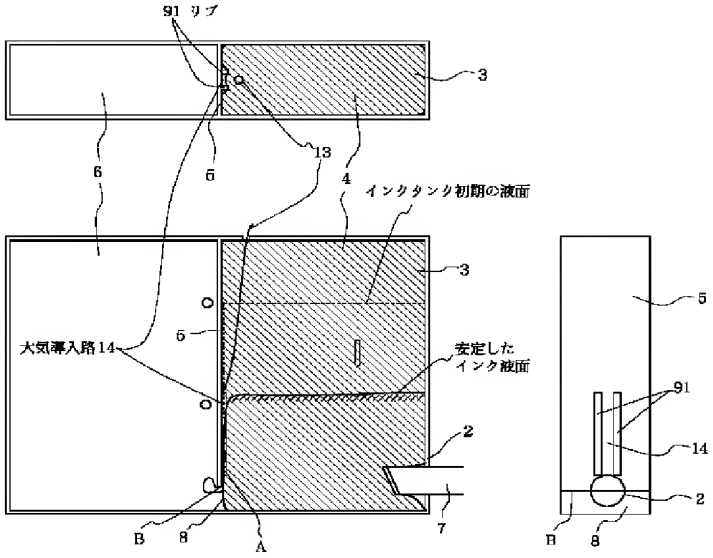
【図１】


（交換インクタンク）1
インク室b
大気連通部13
インク室a
（記録ヘッド）20
ヘッド駆動電極
インク室減圧
圧縮インク吸収体
111
リングシール
係合ガイド
加圧方向
インク
インク室壁
インク供給路
103
ヘッドベースプレート
キャリッジ
ヘッド位置決め部
25
112
115
113
111－1
104
111－2
印字走査方向

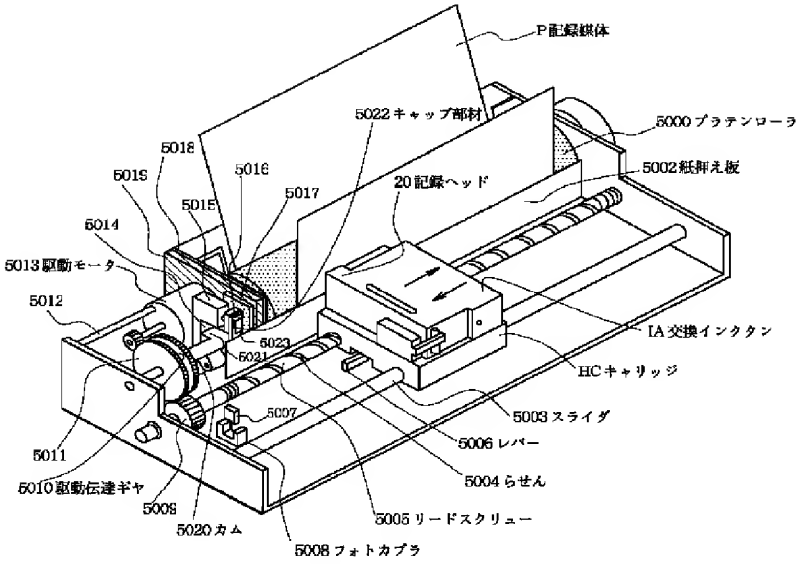
【図２】


1
6
4
13
30
2
20
9
5
8
11
25
10
3
B
7
21

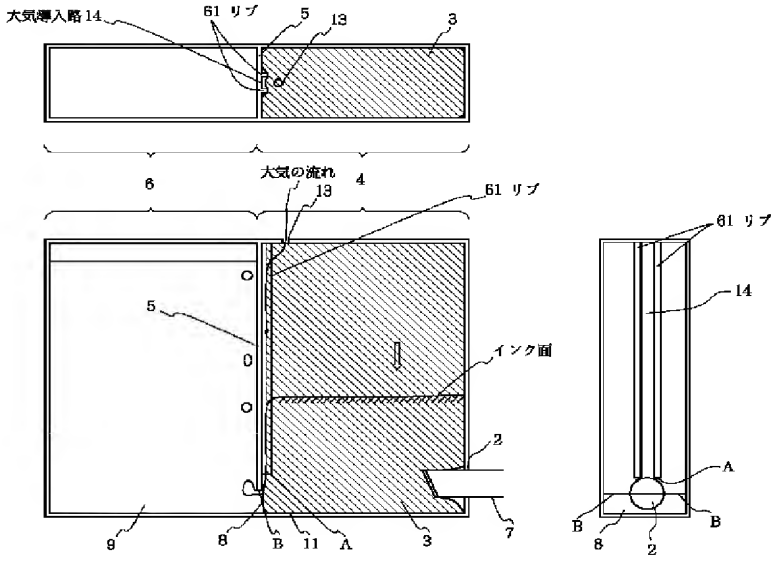
【図８】


91 リブ
3
6
5
13
4
インクタンク初期の液面
3
大気導入路14
5
安定したインク液面
2
B
8
A
7
5
91
14
2
B
8

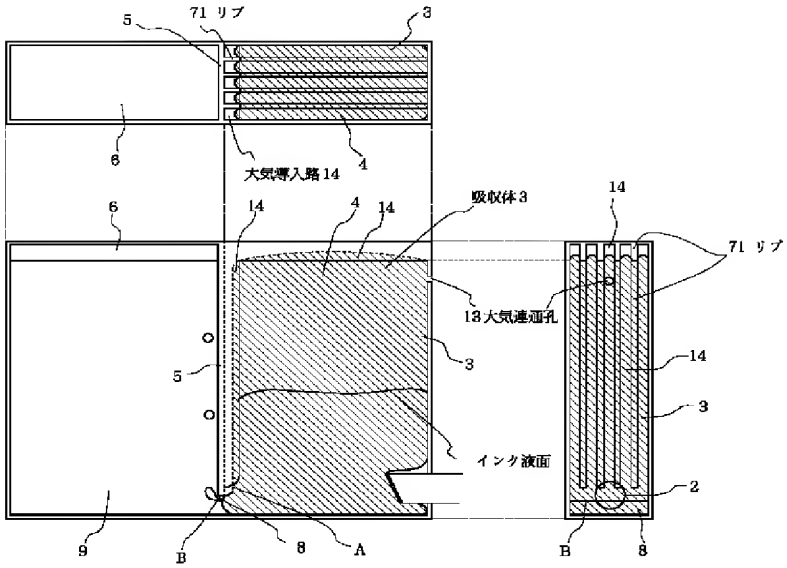
【図４】


P記録媒体
5022キャップ部材
5000プラテンローラ
5018
5019
5016
5017
20記録ヘッド
5002紙押え板
5015
5014
5013駆動モータ
5012
5023
5021
IA交換インクタン
HCキャリッジ
5007
5003スライダ
5006レバー
5011
5004らせん
5010駆動伝達ギヤ
5009
5020カム
5005リードスクリュー
5008フォトカプラ

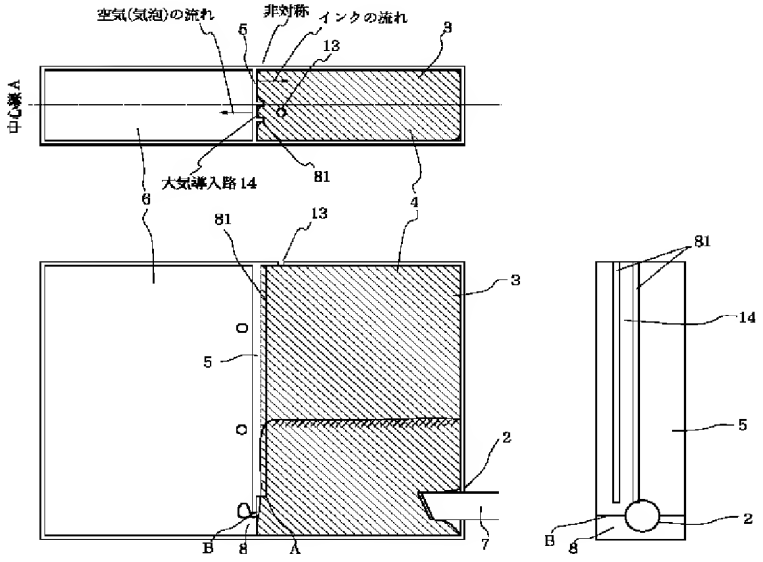
【図５】


大気導入路14
61 リブ
5
13
3
6
大気の流れ
13
4
61 リブ
5
インク面
2
9
8
B
11
A
3
7
61 リブ
14
A
B
B
8
2

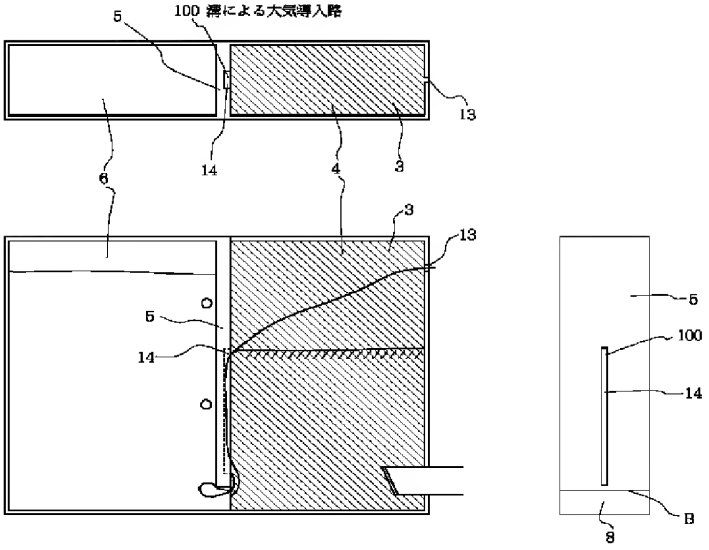
【図６】


5
71 リブ
3
6
大気導入路 14
4
吸収体 3
14
71 リブ
13 大気連通孔
インク液面
2
9
B
8
A

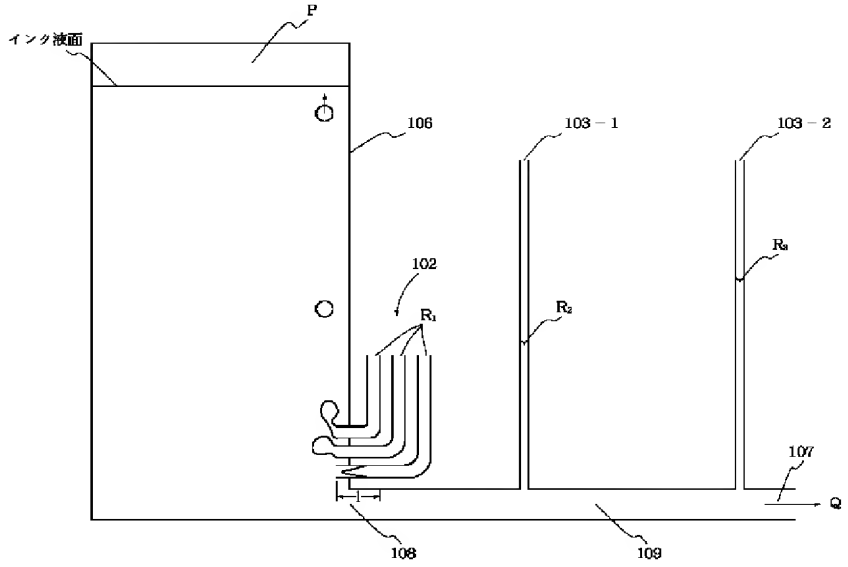
【図７】


空気(気泡)の流れ
非対称
インクの流れ
5
13
3
中心線A
大気導入路 14
81
6
4
2
7
B
8
A
14

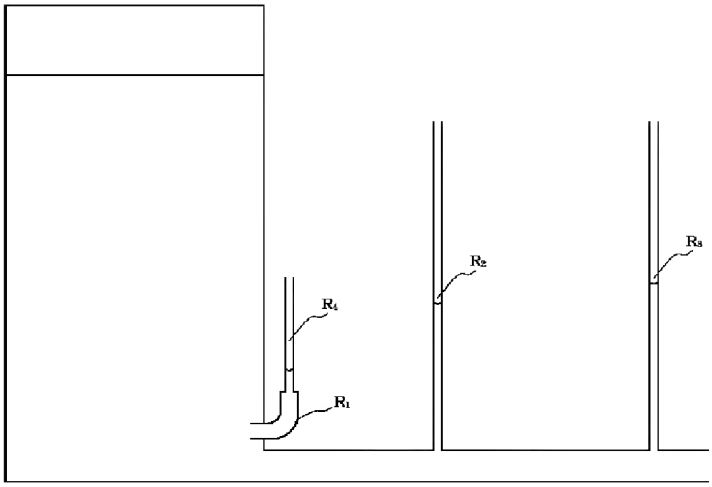
【図９】


100 溝による大気導入路
5
13
14
4
3
6
3
13
5
14
5
100
14
B
8

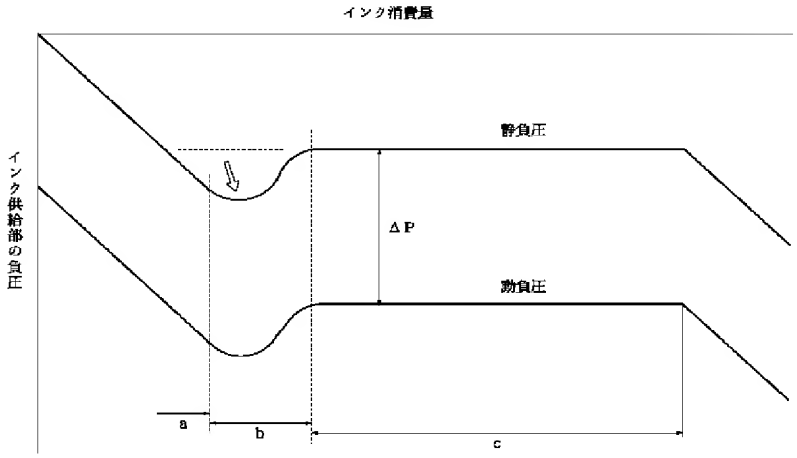
【図１０】


P
インク液面
106
103－1
103－2
102
R1
R2
R3
107
Q
108
109

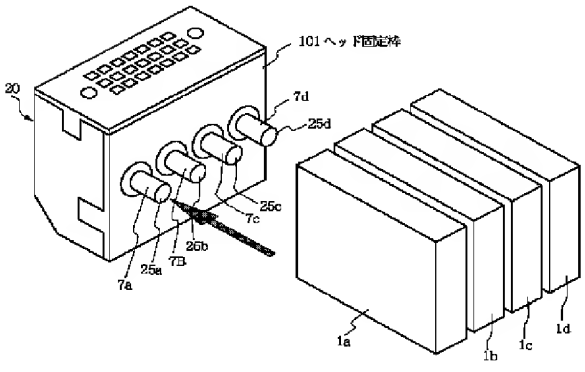
【図１２】


R4
R2
R3
R1

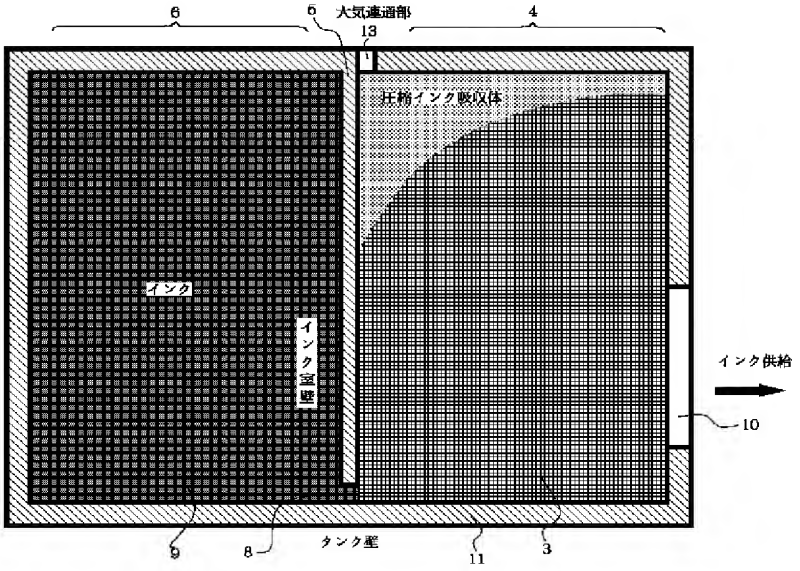
【図１３】


インク消費量
インク供給部の負圧
静負圧
ΔP
動負圧
a
b
c

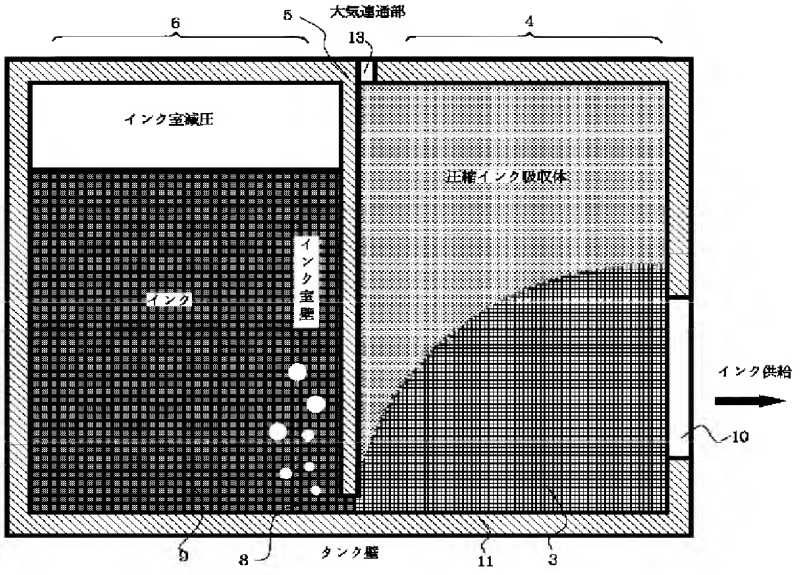
【図１８】


101ヘッド固定枠
20
7d
25d
25c
7c
26b
7b
25a
7a
1a
1b
1c
1d

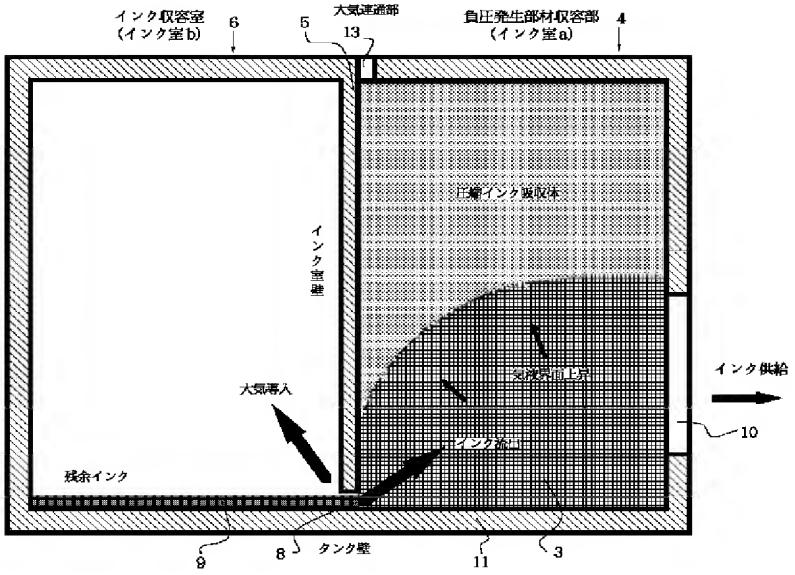
【図１４】


6
5
大気連通部
13
4
圧縮インク吸収体
インク
インク室壁
インク供給
10
9
8
タンク壁
11
3

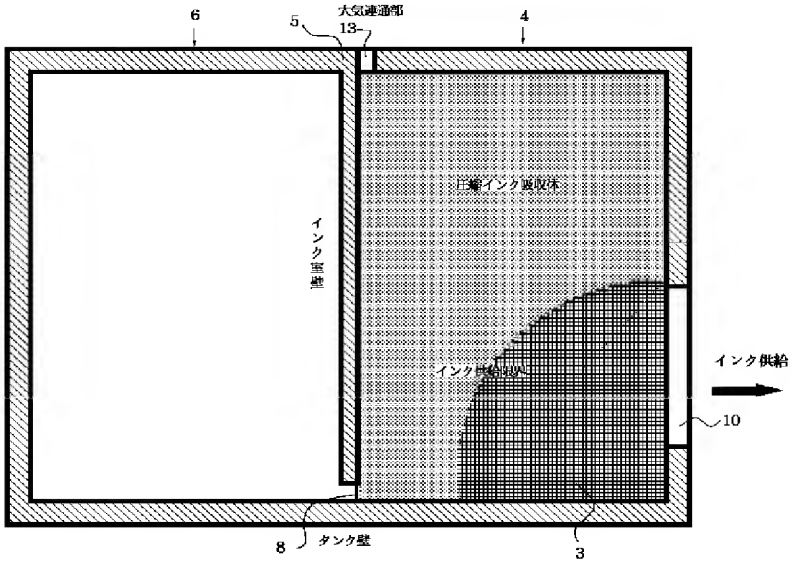
【図１５】


6
5
大気連通部
13
4
インク室減圧
圧縮インク吸収体
インク
インク室壁
インク供給
10
9
8
タンク壁
11
3

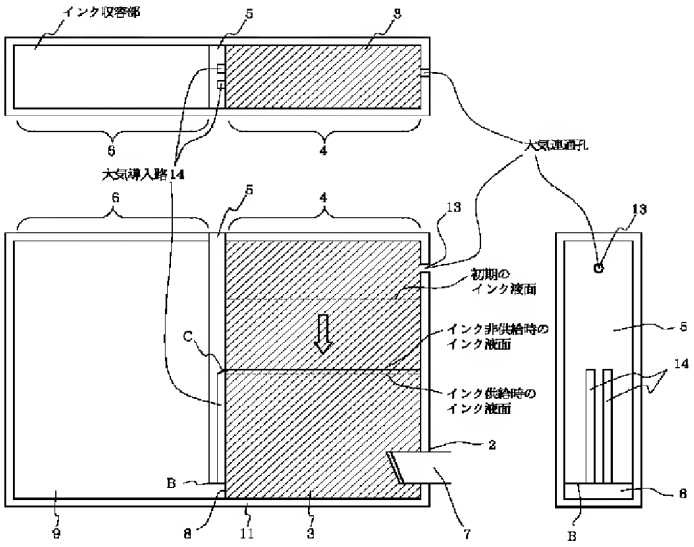
【図１６】


インク収容室
（インク室b）
6
5
大気連通部
13
負圧発生部材収容部
（インク室a）
4
吐出インク貯蔵体
インク室壁
インク供給
大気導入
インク流
10
残余インク
9
8
タンク壁
11
3

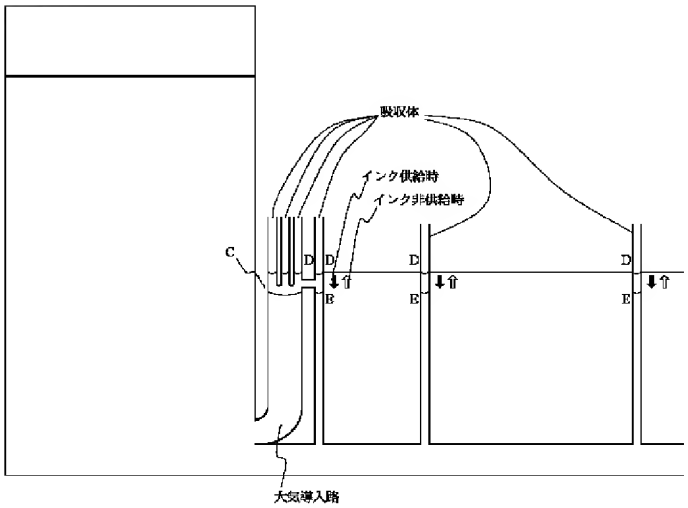
【図１７】


6
5
大気連通部
13
4
吐出インク貯蔵体
インク室壁
インク供給
10
8
タンク壁
3

【図１９】




【図２０】

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